EXABYTE®

EXB-10h and EXB-10e 8mm Library

SCSI Reference

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Revision History

Revision	Date
000	January 1993 (beta draft)
001	March 1993
002	February 1995 (see page iv for changes to this revision)

Product Warranty Caution

The EXABYTE® EXB-10h and EXB-10e 8mm Libraries (referred to collectively as the "library") are warranted to be free from defects in materials, parts, and workmanship and will conform to the current product specifications upon delivery. **For the specific details of your warranty, refer to your sales contract or contact the company from which the library was purchased.**

The warranty for the library shall not apply to failures caused by:

- Physical abuse or use not consistent with the operating instructions or product specifications provided by Exabyte's personnel or agent for the applicable equipment.

- Modifications by other than Exabyte's personnel or agent in any way other than those approved by Exabyte, provided the warranty shall not be voided by the repair or replacement of parts or the attachment of items in the manner described in maintenance or installation instructions provided by Exabyte.

- Repair by other than Exabyte's personnel or agent in a manner contrary to the maintenance instructions provided by Exabyte.

- Removal of the Exabyte serial number tag.

- Physical abuse due to improper packaging of returns.

CAUTION

Returning the library in unauthorized packaging may damage the unit and void the warranty.

If you are returning the library for repair, package it in its original packaging (or in replacement packaging obtained from your vendor).

If problems with the library occur, contact your maintenance organization; do not void the product warranty by allowing untrained or unauthorized personnel to attempt repairs.

Changes and Enhancements to This Revision

This revision (510852-002) of the *EXB-10h and EXB-10e SCSI Reference* replaces the *EXB-10e SCSI Reference* (510852-001). This manual includes the following changes and enhancements:

■ Information about the EXB-10h, which supports half-high 8mm tape drives, has been added.

■ Chapters 1 and 2 have been reorganized to provide an overview of how the library operates as a SCSI device and an introduction to common library SCSI operations.

■ A reference for the LCD character set has been added (Appendix C).

■ A reference for library error codes has been added (Appendix D).

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About This Manual

This manual provides reference information for developing SCSI (Small Computer System Interface) applications for the EXABYTE® EXB-10h or EXB-10e 8mm Library (referred to collectively as the *library*). Note that library SCSI operations are separate from the SCSI operations performed by the enclosed tape drive. For SCSI operations as they relate to the tape drive, refer to the tape drive SCSI reference manual.

Contents of This Manual

This manual contains the following information:

- Chapter 1 contains information about how the library operates as a device in a SCSI environment. It includes a description of the library's features, control modes, and elements, and an overview of library SCSI communication, including bus phases, messages, and the SCSI command set.

- Chapter 2 describes common library SCSI operations.

- Chapter 3 contains information about the general conditions that the library checks and the errors that can occur during the Command phase.

- Chapters 4 through 17 contain information about individual SCSI commands. For ease of reference, the commands are listed in alphabetical order.

- Appendix A describes how the library handles errors during different SCSI bus phases.

- Appendix B describes how the library processes SCSI messages during different SCSI bus phases.

- Appendix C provides a table listing the hexadecimal values for the LCD character set.

- Appendix D provides reference information for library errors.

- A glossary, index, and reader's comment form are included at the back of the manual.

Conventions Used in This Manual

This manual uses the special conventions shown below to highlight notes, important information, cautions, and warnings. Take special note of boxed text. Failure to follow cautions and warnings can result in equipment damage or personal injury!

Note: Read *Notes* for hints or suggestions about the topic or procedure being discussed.

► **Important:**   Read the information in *Important* notices to learn crucial information about the topic being discussed.

CAUTION

Read the information in *CAUTION* boxes to learn how to avoid damaging equipment or losing data.

Related Publications

This manual provides guidelines for implementing the library's SCSI command set. The following publications list additional, related information.

EXB-10h and EXB-10e

- *EXB-10h 8mm Library Product Specification*, 310377

- *EXB-10h 8mm Library Installation and Operation*, 310376

- *EXB-10e 8mm Cartridge Handling Subsystem Product Specification*, 510851

- *EXB-10e 8mm Cartridge Handling Subsystem Installation*, 510855

- *EXB-10e 8mm Cartridge Handling Subsystem Operator's Guide*, 510853

- *EXB-10e 8mm Cartridge Handling Subsystem Error Codes*, 510854

Half-High 8mm Tape Drives

- *EXB-8205 and EXB-8505 8mm Cartridge Tape Subsystems SCSI Reference for Standard and eXtended-Length Configurations*, 510503

- *EXB-8205 and EXB-8505 8mm Cartridge Tape Subsystems Integration and Optimization for Standard and eXtended-Length Configurations*, 510505

- *EXB-8205 and EXB-8505 8mm Cartridge Tape Subsystems Product Specification for Standard and eXtended-Length Configurations*, 510504

Full-High 8mm Tape Drives

- *EXB-8200 8mm Cartridge Tape Subsystem Product Specification*, 510005

- *EXB-8200 8mm Cartridge Tape Subsystem User's Manual*, 510006

- *EXB-8200SX 8mm Cartridge Tape Subsystem Product Specification and User's Manual*, 510011

- *EXB-8500 and EXB-8500c 8mm Cartridge Tape Subsystem Product Specification*, 510200

- *EXB-8500 8mm Cartridge Tape Subsystem User's Manual*, 510201

- *EXB-8500c 8mm Cartridge Tape Subsystem User's Manual*, 510209

Standards

For information about the standards used for the library, refer to the following:

- ANSI *Small Computer System Interface* (*SCSI*), X3.131-1989

- ANSI *Small Computer System Interface-2* (*SCSI-2*), X3T9/89-042

- ANSI *Helical-Scan Digital Computer Tape Cartridge*, X3B5/89-136, Rev. 6

Notes:

1 Overview of the Library as a SCSI Device

This chapter provides background information for understanding how an EXABYTE® EXB-10h or EXB-10e 8mm Library operates as a device on a SCSI bus. It provides an overview of the following:

- General features of the library
- Library control modes
- The library's relationship to the SCSI bus
- The elements of the library
- SCSI bus communication, including bus phases, messages, commands, and statuses

1.1 General Features

The library offers the following features:

- One enclosed EXABYTE 8mm tape drive.

- A data cartridge magazine with ten slots for cartridges.

- A robotic handler that moves 8mm data cartridges between the cartridge magazine and tape drive. This robotic handler is referred to as the *cartridge handling mechanism* (CHM).

- An operator panel that includes a liquid crystal display (LCD) and keypad. The operator panel enables you to view the status of the library and access a menu of operations.

- Two SCSI connectors that can accommodate two SCSI cables or one cable and an external terminator.

Differences Between the EXB-10h and EXB-10e

The primary difference between the EXB-10h and the EXB-10e is that the EXB-10h supports half-high 8mm tape drives (EXB-8205, EXB-8505, EXB-8205XL, and EXB-8505XL), while the EXB-10e supports full-high 8mm tape drives (EXB-8200, EXB-8200SX, EXB-8500, and EXB-8500c).

Both libraries operate identically except for how cartridges are inserted into the tape drive. The tape drives supported by the EXB-10h have no door. The CHM inserts the cartridge directly through the opening in the faceplate. The flap covering the opening is pushed aside by the cartridge as it enters the tape drive. The tape drives supported by the EXB-10e have a door that swings open to accept the cartridge. After positioning the cartridge in the tape drive, the CHM pushes the door shut. The cartridge is not considered completely inserted until the door is shut.

Because of this difference in operation, slight differences may exist in the way the libraries execute certain commands. These differences are noted in the SCSI command chapters.

The other main difference between the libraries is that the EXB-10e issues a Unit Attention sense key when the data cartridge magazine is replaced, while the EXB-10h does not (see page 3-13).

1.2   Control Modes

The library can operate in any of the following control modes:

- **LCD mode**, in which CHM motion is controlled by a user from the operator panel.

- **CHS Monitor mode**, in which CHM motion is controlled by remote diagnostics software running through the Monitor port.

- **Sequential mode**, in which CHM motion is controlled by the library's internal firmware. In this mode, the CHM sequentially picks data cartridges from the data cartridge magazine (moving from bottom to top) and processes them in the tape drive.

■ **Random mode**, in which CHM motion is controlled by a SCSI driver. In this mode, the CHM retrieves and replaces data cartridges in an order you specify through the SCSI-2 command set.

> **Note:** You can issue SCSI commands to the library in any of the control modes. However, the library must be in Random mode if you want to control CHM motion with SCSI commands.

Refer to your library's operating instructions for using the LCD to switch among these control modes.

1.3   Relationship to the SCSI Bus

The Small Computer System Interface (SCSI) is a standard that enables a host computer and peripheral equipment, such as the library and its tape drive, to communicate. The physical components of the SCSI system are the following:

■ **Initiator or host.** A SCSI host bus adapter (HBA) card installed in a host computer allows the computer to act as the initiator of SCSI operations. The initiator can send commands, messages, and data across the SCSI bus to targets such as the library or tape drive. The initiator can also receive data, messages, and status from the targets.

■ **Targets.** The library and tape drive are independent targets capable of receiving commands from the host. The library is the target for cartridge movement operations. The tape drive is the target for read and write operations.

■ **SCSI bus.** The SCSI cables, which connect the SCSI bus adapter card to the library and tape drive, form the SCSI bus and provide a pathway for passing information between the initiator and the targets. Up to eight devices (including one or more initiators) can be cabled together to form a SCSI bus. Each device attached to a SCSI bus has a unique SCSI ID that identifies it during communication. SCSI IDs can range from 0 to 7 for each bus.

The library is available in either a single-ended or differential SCSI configuration.

1.4　Elements and Element Addresses

When you issue SCSI commands to the library, you may need to specify an *element address* to identify a specific location (called an *element*). The library includes three different types of elements:

- **Medium transport element.** The cartridge handling mechanism (CHM) is the medium transport element that moves the cartridges between the tape drive and their storage slots in the library.

- **Storage elements**. The ten data cartridge slots in the library's data cartridge magazine (also known as a data cartridge holder or "10-pack") are the storage elements that store the cartridges while they are not being used in the tape drive.

- **Data transfer element.** The 8mm tape drive is the data transfer element that reads and writes data.

Each element has a default element address, as shown in Figure 1-1. Explanations of how you use the element addresses and how you can change them are provided in Chapter 2.

> **Note:**　When you use LCD diagnostic functions from the operator panel, you indicate locations by specifying *element indexes*. Element indexes are identical to the default element addresses. However, element indexes are permanently coded in the library's firmware and cannot be changed. Element addresses can be changed with the MODE SELECT command.

Cartridge Slots

10
9
8
7
6
5
4
3
2
1

CHM

11

Tape Drive

0
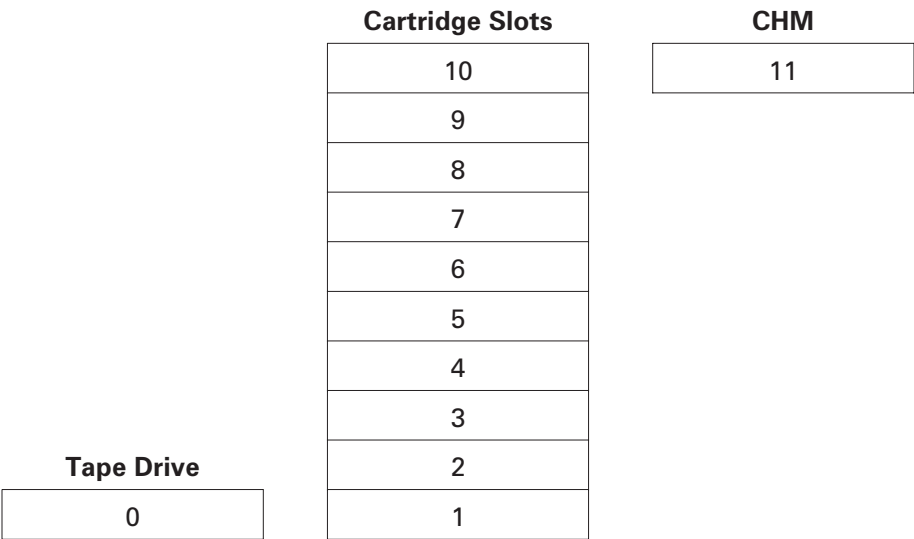
Figure 1-1 Default element addresses (element indexes)

1.5   Communication Across the SCSI Bus

This section describes how communication across the SCSI bus is implemented. It discusses the SCSI bus phases, messages, commands, and statuses supported by the library.

SCSI Bus Phases

Bus phases determine the direction and type of information transferred across the data lines of the SCSI bus. The possible bus phases include Bus Free, Arbitration, Selection, Reselection, and Transfer (which includes four subsets: Message In or Message Out, Command Out, Data In or Data Out, and Status In). Table 1-1 describes the bus phases supported by the library.

Note: For information about how the library responds to errors during different bus phases, refer to Appendix A.

Table 1-1 SCSI bus phases and information transfer phases

Bus phase	Description
Bus Free	The Bus Free phase specifies that no device is using the bus.
Arbitration	The Arbitration phase allows devices to compete for access on the bus.
Selection	The Selection phase allows an initiator to select the target for communication.
Reselection	The Reselection phase allows the target to reconnect to the host after it disconnects.
Transfer: Message In/ Message Out	The Message phases help manage the physical path between the initiators and targets. In the Message Out phase, the initiator sends a message to the target. In the Message In phase, the target sends a message to the initiator.
Command Out	In the Command Out phase, the initiator sends commands to the target. Commands contain information about what actions the target should perform.
Data In/Data Out	In the Data In phase, the target transfers data to the initiator. In the Data Out phase, the initiator transfers data to the target.
Status In	In the Status In phase, the target returns a status byte to the initiator after every command operation. The status byte indicates the results of the command's execution.

SCSI Messages

The message system allows communication between an initiator and the library for physical path management. These messages allow the initiator and the library to manage error detection, data transfer retries, and the data path.

The library supports the SCSI messages listed in Table 1-2. For a more in-depth discussion of these messages and a description of the actions performed by the library in response to these messages, refer to Appendix B.

> **Note:** The library only supports messages that are one byte long. One or more messages can be sent during a single message phase.

Table 1-2 SCSI messages supported by the library

Message	Hex Value	Description	In (Library to Initiator)	Out (Initiator to Library)
			Direction	
Command Complete	00h	The library informs the initiator that the execution of the command was completed and that it sent a valid status byte to the initiator.	✔	
Restore Pointers	03h	The library informs the initiator that it did not properly receive a block of data and that the data needs to be transferred again.	✔	
Disconnect	04h	The library informs the initiator that it plans to disconnect from the SCSI bus and that a reconnect will be required later.	✔	
Initiator Detected Error	05h	The initiator informs the library that an error occurred. The library can retry the operation.		✔
Abort	06h	The initiator is clearing the present and any pending operation for that initiator. When the library accepts this message, it releases the bus into the Bus Free phase.		✔
Message Reject	07h	Either the initiator or the library is indicating that the last message received was inappropriate or not implemented.	✔	✔
No Operation	08h	The initiator informs the library that it does not have a valid message to send in response to the library's request for a message.		✔
Message Parity Error	09h	The initiator informs the library that one or more bytes in the last message it received had a parity error.		✔
Bus Device Reset	0Ch	The initiator instructs the library to reset all of its current I/O operations for all initiators. The library releases the SCSI bus into the Bus Free phase, with no operations pending for any initiator, and performs a soft reset.		✔
Identify	80h or C0h	This message is used to establish a physical path connection between the initiator and the target for a particular LUN (logical unit number). The library supports a LUN of 0.	✔	✔

SCSI Commands

Table 1-3 lists the SCSI commands supported by the library.

Note: The commands issued to the library are independent of the commands issued to the tape drive. For information about the commands for the tape drive, refer to the SCSI Reference for the tape drive.

Table 1-3 SCSI commands supported by the library

OP Code	Command	Discussed in...
00h	TEST UNIT READY (6 bytes)	Chapter 17
03h	REQUEST SENSE (6 bytes)	Chapter 14
07h	INITIALIZE ELEMENT STATUS (6 bytes)	Chapter 4
12h	INQUIRY (6 bytes)	Chapter 5
15h	MODE SELECT (6 bytes)	Chapter 7
16h	RESERVE (6 bytes)	Chapter 15
17h	RELEASE (6 bytes)	Chapter 13
1Ah	MODE SENSE (6 bytes)	Chapter 8
1Ch	RECEIVE DIAGNOSTIC RESULTS (6 bytes)	Chapter 12
1Dh	SEND DIAGNOSTIC (6 bytes)	Chapter 16
2Bh	POSITION TO ELEMENT (10 bytes)	Chapter 10
4Dh	LOG SENSE (10 bytes)	Chapter 6
A5h	MOVE MEDIUM (12 bytes)	Chapter 9
B8h	READ ELEMENT STATUS (12 bytes)	Chapter 11

Chapters 4 through 17 contain the detailed descriptions of the SCSI commands supported by the library. The commands are arranged in alphabetical order with each command starting in a new chapter. For ease of reference, the command name and operation code (OP code) are included in the header at the top of each page.

SCSI Command Format

The library uses six-, ten-, and twelve-byte commands, whose formats are described in the SCSI-2 standard. Any command descriptor block (CDB) fields that are specific to the library for a given command are described in the command chapter. This section describes the CDB fields that are common for every command.

Note: Any errors caused by illegal parameters in a CDB or parameter list for a particular command are listed at the end of the command chapter. Errors of this type return a sense key of Illegal Request (5h).

Logical Unit Number (LUN)   The library is a single device target and does not support multiple devices. The library only supports a LUN of 0. The LUN field for each CDB should be set to 0. Note that if the Identify message is sent before the CDB, the LUN field of the CDB is ignored. However, the LUN field in the Identify message must be set to 0.

Reserved Fields   The word *Reserved* (or *RSVD*) in a field definition for a SCSI command refers to fields defined as reserved by the SCSI-2 standard. The library checks these fields for a value of 0. If a 0 is not present, the library returns Check Condition status with a sense key of Illegal Request (5h).

Control Byte   The vendor unique portion of the Control byte (as indicated in the SCSI-2 standard) is defined for each specific command, if used. The library does not support linked commands or recognize the Flag bit.

Fields Not Implemented   The field description, "This field not supported by the library," indicates that the field is supported by the SCSI-2 standard, but is not implemented in the library.

SCSI Command Status Bytes

The library sends one status byte to the initiator in response to each command.

Table 1-4 contains a summary of the status bytes used by the library. Chapter 3 contains descriptions of the conditions that are checked and the order in which they are checked to enable the library to determine status after receiving a command.

Table 1-4 SCSI command status bytes supported by the library

Hex Value	Description
00h	**Good** Indicates that the library successfully completed the operation specified by the CDB.
02h	**Check Condition** Indicates an error, exception, or abnormal condition that has caused sense information to be set.
08h	**Busy** Indicates that the library is unable to accept a command from an initiator.
18h	**Reservation Conflict** Indicates that the elements identified in the command are reserved by another initiator.

Note: The library may go to the Bus Free phase without reporting status in response to a command sequence. If this happens, immediately issue a REQUEST SENSE (03h) command to determine the cause of the unexpected disconnect.

Status Descriptions

The following are expanded descriptions of the status bytes listed in Table 1-4.

Good The library returns Good status to indicate that the operation specified by the CDB completed normally.

Check Condition The library returns Check Condition status to indicate that an error has occurred while it is executing a command. The library reports Check Condition status as soon as it detects the error unless the library is disconnected from the SCSI bus. If the library is disconnected, it reports Check Condition status to the initiator after the reconnect process.

Examples of situations that result in Check Condition status are listed below:

- The library detects a SCSI message error. For example, if immediately following selection, the initiator sends an Identify message with the reserved bits set to a value other than 0, the library returns Check Condition status.

- The initiator sends an Identify message with an invalid LUN or sends a command other than INQUIRY or REQUEST SENSE with an invalid LUN without first sending a valid Identify message.

- The initiator sends a command other than INQUIRY or REQUEST SENSE when there is a pending Unit Attention condition for the library.

- The library has an unrecoverable hardware error and receives a motion command.

- The library is not ready when it receives a CHM motion command. The library is not ready when it is operating in sequential mode, LCD mode, or CHS Monitor mode.

- A reserved field is set to a value other than 0 in the CDB or parameter list for the requested command.

- An invalid parameter is specified in the CDB or parameter list for the requested command.

- The command fails for one of the reasons listed in the command chapter. For example, a MOVE MEDIUM command terminates with Check Condition status if the source for the move is empty.

For specific situations that return Check Condition status, refer to the command descriptions in Chapters 4 through 17.

Busy The library returns Busy status to any initiator that sends a command other than INQUIRY or REQUEST SENSE when the library is disconnected from the SCSI bus or when it is waiting for a SCSI motion process to be aborted.

If allowed, the library disconnects from the SCSI bus when performing any lengthy operations, such as a move operation.

The library aborts motion processes in response to an Abort message from the initiator that requested the motion command. The library has to abort the motion process completely before it can process commands other than INQUIRY and REQUEST SENSE.

Reservation Conflict   The library returns Reservation Conflict status to indicate that either the entire library or the elements requested to be accessed are currently reserved by another initiator. This status is reported until the initiator that reserved the library or elements issues a RELEASE (17h) command or a reset condition occurs.

2 Implementing SCSI Operations

This chapter provides information about performing the following common SCSI operations:

- Controlling parity checking
- Disconnecting from the SCSI bus
- Resetting the library
- Setting element addresses
- Using the cartridge inventory
- Moving data cartridges
- Reserving elements
- Inquiring about library status
- Performing diagnostic tests

For detailed information about the SCSI commands that the library uses to perform these operations, refer to Chapters 4 through 17.

2.1 Controlling Parity Checking

When it receives data (commands, messages, and so on) across the SCSI bus from the initiator, the library can check this information for parity and notify you if a parity error has occurred. When the library is shipped from the factory, parity checking is enabled. You control parity checking using combinations of the following:

■ **The Parity bit on the Parity page in the MODE SELECT (15h) command** (described in Chapter 7). The factory default is 1 (enabled).

■ **The parity option on the LCD Set-up Menu** (described in the operating instructions provided with your library). The factory default is ON (enabled).

If you want to disable parity checking, use either (or both) of the following methods:

■ Send a MODE SELECT command with the Parity bit set to 0.
■ Set the LCD parity option to OFF.

The change takes effect immediately.

> **Notes:**
>
> ■ If you disable parity checking using the MODE SELECT command, but do not change the LCD parity option to OFF, parity checking will be off even though the LCD indicates that it is on.
>
> ■ If you disable parity checking using the MODE SELECT command, but do not save the MODE SELECT parameters (see Chapter 7), parity checking is re-enabled after you reset the library or turn power off and back on.
>
> ■ If you disable parity checking using the LCD, but do not change the MODE SELECT Parity bit, parity checking is re-enabled after you reset the library or turn power off and back on.

If you want to re-enable parity checking, use *both* of the following methods:

■ Send a MODE SELECT command with the Parity bit set to 1.
■ Set the LCD parity option to ON.

2.2   Disconnecting from the SCSI Bus

The library disconnects from the SCSI bus to process a command that requires a lengthy amount of time, thereby freeing the SCSI bus to allow another I/O process to occur. The library can disconnect from the SCSI bus only if it has been granted permission to do so by the initiator. To grant the library permission to disconnect, do the following:

1. Select the library with the Attention signal to enable the message system.

2. Send the library an Identify message with the DiscPriv bit set to 1.

If an initiator grants the library permission to disconnect and then makes a request to process a command that requires a lengthy amount of time, the following occurs:

1. The library disconnects from the SCSI bus to process the command. It does not send a Save Data Pointers message to the initiator.

2. When the library is finished processing the command, it arbitrates for the SCSI bus.

3. Upon winning arbitration, the library reselects the initiator and sends an Identify message to the initiator.

   This revives the I_T_L nexus (initiator-target-LUN connection) so that the initiator can retrieve the correct set of pointers for the I/O process.

4. The initiator restores the active pointers to their most recent saved values (which, in this case, are the initial values), and the library completes the I/O process.

While disconnected, processing the command, or trying to reconnect to the initiator, the library returns Busy status to other initiators requesting commands other than REQUEST SENSE (03h) and INQUIRY (12h). If the same initiator selects the library to request another command, an Invalid Initiator Reselection occurs. (See Chapter 3 for more information.)

2.3   Resetting the Library

You can use any of the following methods to reset the library and tape drive.

CAUTION

Resetting or powering off the library will reset the SCSI bus. To prevent possible loss of data, make sure that all devices attached to the SCSI bus are inactive and have completed all requested operations before powering off or resetting the library.

- **Power-on reset.** Power the library off and back on again to reset the library and tape drive.

- **Operator panel reset.** Press ⌐Reset⌐ on the operator panel to reset the library.

- **SCSI bus reset.** Send a RST pulse on the SCSI bus for a minimum of 25 μsec. A SCSI bus reset immediately clears all devices from the bus, resets their associated equipment, and terminates all pending I/O processes.

- **SCSI Bus Device Reset message.** Issue a Bus Device Reset (0Ch) message to the library or tape drive to reset the individual device. A Bus Device Reset message clears the device from the bus, causes all commands sent to it to be cleared, and terminates all pending I/O processes. Note that a Bus Device Reset message received by the library does not reset the tape drive.

  Notes: If a SCSI bus or device reset occurs during a power-on reset, the power-on reset will be restarted.

  If the library is performing a cartridge move operation when it is reset, it finishes the move operation as soon as the reset is complete.

Effect of Power-on and Operator Panel Resets

The power-on and operator panel reset has the following effects:

- If the library is connected to the SCSI bus, the SCSI bus goes to the Bus Free phase.

- The checksum of the flash EEPROM code is validated.

- All library parameters are reset to their default states.

- The library performs its power-on self-test.

After a power-on reset, the library will respond on the SCSI bus within three seconds.

Effect of SCSI Bus and Device Resets

A SCSI bus reset or device reset has the following effects:

- If the library is connected to the SCSI bus, the SCSI bus goes to the Bus Free phase.

- All library parameters are reset to their default states.

- The library performs its power-on self-test.

- A SCSI bus reset also resets the tape drive which then performs its power-on self test.

After a SCSI bus or device reset, the library will respond on the SCSI bus within 250 msec.

Note: If the device that supplies SCSI bus terminator power is powered off, the RST line is left in an indeterminate state (either reset or not, depending on the voltages). It may be impossible to communicate with the library. To avoid this situation, you may want to place the library at the end of the SCSI bus so that you have an external terminator on one of the library's SCSI connectors.

2.4   Setting Element Addresses

If you want, you can assign different element addresses to the library's elements (storage, data transfer, and medium transport). You may want to do this create a single "virtual" library from multiple libraries. By assigning unique element addresses to every element in each of the libraries in your system, you can ensure that cartridges can be easily located no matter which library they are in.

Figure 1-1 on page 1-5 shows the default element addresses assigned to each element in the library. When choosing to assign new addresses to the data cartridge slots, you assign the first number to the first slot and the library automatically assigns the other nine sequentially.

To assign different element addresses for the library, use the MODE SELECT (15h) command. To view the current addresses, use the MODE SENSE (1Ah) command or view the assigned element addresses through the LCD's SCSI menu (choose the SCSI Mode Parameters submenu from the SCSI menu).

2.5   Using the Cartridge Inventory

The library maintains a cartridge inventory in nonvolatile RAM. The inventory contains information about the 12 element locations in the library:

- Medium transport element (one CHM)
- Storage elements (10 slots in the data cartridge magazine)
- Data transfer element (one tape drive)

The library uses the information stored in the cartridge inventory to process SCSI commands.

Establishing the Cartridge Inventory

To set up the library's cartridge inventory, use the INITIALIZE ELEMENT STATUS (07h) command. This command causes the library to check for the presence of cartridges in the tape drive and in the data cartridge magazine. The library then stores this information in the cartridge inventory.

After the cartridge inventory has been established, you can use the INITIALIZE ELEMENT STATUS (07h) command to update the entire cartridge inventory whenever the integrity of the inventory is questionable (for example, after the door has been opened).

Retrieving Cartridge Inventory Information

Once the current cartridge inventory has been determined using an INITIALIZE ELEMENT STATUS command, you can retrieve inventory information by issuing a READ ELEMENT STATUS (B8h) command (see Chapter 11).

When the Cartridge Inventory is Questionable

The library must ensure that the data integrity of the cartridge inventory remains intact. The cartridge inventory is reset to a questionable state when there is any possibility that a user manually moved cartridges, added cartridges, removed cartridges, exchanged magazines, or removed or replaced a cartridge in the tape drive. The library's cartridge inventory becomes questionable when:

- The library is powered off and then on
- The library is reset
- The library's door is opened and then closed

Types of Information Stored in the Cartridge Inventory

The library maintains the following fields of information for every location:

- Element address
- Element occupied status
- Source element status
- SCSI element reservation

Element Address

The element address field contains the address of the element location. Use element addresses to reference element locations when you issue SCSI commands to the library. You can change element addresses by using the MODE SELECT (15h) command (see Chapter 7). Figure 1-1 on page 1-5 shows the default element addresses for the library.

Element Occupied Status

The library uses the Occupied and Occupied Valid flags in the cartridge inventory to determine whether a given element is occupied as follows:

Occupied   The Occupied flag indicates whether the library considers the specified element location to contain a data cartridge, as follows:

0 – Element location does not contain a data cartridge
1 – Element location contains a data cartridge

Occupied Valid   The Occupied Valid flag indicates whether the Occupied flag is accurate, as follows:

0 – The Occupied flag is questionable (may not be accurate)
1 – The Occupied flag is accurate

The Occupied Valid flag is set to 0 after the library is powered off and then on again, reset, or when the door is opened to indicate that a data cartridge could have been added or removed from the location. The Occupied Valid flag is set to 1 when an operation that validates the Occupied flag, such as an initialize element status or a move operation, is performed.

Source Element Status

The library uses the Source Element Address and Source Address Valid fields in the cartridge inventory to determine the source element address, as follows:

Source Element Address   The Source Element Address field shows the address of the last storage element from which the cartridge was moved.

Source Element Address Valid   The Source Element Address Valid flag indicates whether the Source Element Address field is accurate, as follows:

0 – The Source Element Address field is questionable
1 – The Source Element Address field is accurate

The Source Element Address field is set to FFh and the Source Element Address Valid flag is set to 0 after the library is reset or when the door is opened (to indicate that a data cartridge magazine could have been added or removed from the location during the reset or when the door was opened). After a move operation, the Source Element Address field is set to the address of the source cartridge and the Source Element Address Valid flag is set to 1.

SCSI Element Reservation

Using the RESERVE (16h) command, an initiator can either reserve the entire library as a unit or reserve individual elements or groups of elements for its exclusive use. The library uses three fields to indicate element reservation by an initiator:

Reserved   The Reserved flag indicates whether the element is reserved by an initiator, as follows:

0 – The element is not reserved
1 – The element is reserved

Host ID   The Host ID field contains the SCSI ID of the initiator that reserved the element.

Reservation ID   The Reservation ID field contains the reservation ID as set in the RESERVE command.

Note: When the library is reset, all reservation information is cleared.

2.6   Moving Data Cartridges

To instruct the library to move data cartridges between the storage locations (cartridge magazine slots) and the tape drive, issue the MOVE MEDIUM (A5h) command. The MOVE MEDIUM command allows you to specify a source element address and a destination element address for a specific move operation. In addition, the POSITION TO ELEMENT (2Bh) command moves the CHM out of the way to allow you to manually access any part of the storage area.

2.7   Reserving Elements

To reserve specific data cartridge locations, the tape drive, the CHM, or the entire library for exclusive use by one initiator, use the RESERVE (16h) command. For example, if any initiator needs to access specific data cartridges, it can issue the RESERVE command to set aside those storage locations so that no other initiator can access the cartridges.

Note: Use the tape drive's RESERVE UNIT command to ensure that the initiator has exclusive use of the tape drive for tape operations.

Once an initiator has reserved an element or the entire library, the same initiator must use the RELEASE (17h) command to cancel the reservation.

2.8 Inquiring About Library Status

To inquire about library status, you can use the following commands:

TEST UNIT READY (00h) Command

Use this command to determine if the library is ready to accept all other commands, including motion commands. This is not a request for a self-test, which occurs at power-on. This command returns Good status if the library is ready to accept any command without returning Check Condition, Reservation Conflict, or Busy status.

REQUEST SENSE (03h) Command

If an error occurs during an operation, use the REQUEST SENSE (03h) command to determine the type of error. This command returns the following information:

- Sense key for the error that indicates the type of error (Not Ready, Hardware Error, Illegal Request, Unit Attention, or Aborted Command)

- Additional sense code (ASC) that indicates the type of error in the given sense key category

- Additional sense code qualifier (ASCQ) that indicates the specific error in the sense key and ASC categories

  Note: This information is also available through the LCD.

INQUIRY (12h) Command

Use the INQUIRY (12h) command to obtain information about the library's firmware level, the version of SCSI supported by the library, and so on.

LOG SENSE (4Dh) Command

Use the LOG SENSE command to retrieve the library's statistical and state information. This type of information includes the following:

- Library statistics
- History of recent library events
- State of the library hardware

2.9   Performing Diagnostic Tests

You can perform diagnostics to find out detailed information about library operations. The SEND DIAGNOSTIC (1Dh) command allows you to run special diagnostic tests. The RECEIVE DIAGNOSTIC RESULTS (1Ch) command allows you to obtain diagnostic results of library operations.

3 General Command Processing

This chapter describes the general conditions that the library checks and the errors that can occur during the Command phase.

> **Note:** This chapter includes only the processing of a command through the Command phase. If the message system is enabled, additional errors can occur anytime the library responds to ATN with a Message Out phase. For more information about the message system and possible error conditions, see Appendix B.

3.1 About General Command Processing

The sequence of events that occurs when the library receives a command is referred to as *general command processing*. General command processing occurs during the Command phase (that is, after the library is selected by an initiator and when it is in the process of reading the command descriptor block).

General command processing is affected by:

- Whether the message system is enabled when the library is selected
- Which command and parameters were sent

This chapter lists general conditions that the library checks and the effect on each command if the condition occurs. As shown in this chapter, the library checks the conditions in the following order:

1. Error conditions before the library receives the CDB

2. Error conditions while the library is receiving the CDB

3. Invalid logical unit number

4. Invalid initiator reselection condition (message system disabled)

5. Reservation conflict condition

6. Busy condition

7. Pending Unit Attention condition

8. Unrecoverable hardware error condition

9. Not Ready condition

10. CDB reserved bit set

Note that if the library can read the CDB successfully and none of these conditions are present, or if they are present but do not affect the requested command, the library checks for any additional conditions specific to the command. For information about the conditions and errors specific to each command, refer to the section called "Command Execution" in the chapter for that command.

Condition 1.　Error Conditions Before the CDB Is Received

Did an error occur before the library received the CDB?

> **Note:**　Error conditions before the CDB is received can occur only when the message system is enabled and the library detects an error during or after the first Message Out phase following selection.

NO

Go to condition 2 (page 3-5).

YES

The library's handling of errors during the first Message Out phase is independent of the requested command, since the command is not yet known. The following errors can occur:

- **Invalid first message.** If the first message received during the Message Out phase following selection is not the Abort message, Bus Device Reset message, or Identify message, the library immediately goes bus free. Sense data is not set because a logical unit number (LUN) has not been established.

- **Invalid Identify message.** If the Identify message has one or more reserved bits set, the library returns Check Condition status and sets the sense data as follows:

Sense Key	Illegal Request (5h)
ASC	Invalid Bits in the Identify Message (3Dh)
ASCQ	0

- **Improper message sequence.** If the initiator sent an improper message sequence (for example, the initiator sends an Identify message followed by a Message Parity Error message), the library returns Check Condition status and sets the sense data as follows:

Sense Key	Aborted Command (Bh)
ASC	Message Error (43h)
ASCQ	0

■ **Invalid initiator reselection** If the library is disconnected from an initiator to perform a lengthy operation and the same initiator selects the library with Attention and does not send an Abort message or Bus Device Reset message in the Message Out phase following selection, the library takes the following action:

1. It aborts the command that it was processing.

2. It returns Check Condition status and sets the sense data as follows:

Sense Key	Aborted Command (Bh)
ASC	Overlapped Commands Attempted (4Eh)
ASCQ	0

Note: Refer to page 3-8 for more information about an invalid initiator reselection.

■ **Unexpected SCSI status.** If the library encounters an unusual condition, such as an unexpected status returned from the SCSI hardware, it sets the sense data as follows:

Sense Key	Hardware Error (4h) or Aborted Command (Bh)
ASC	Internal Target Failure (44h)
ASCQ	80h to AFh

When such an error occurs, there may be a problem with the library firmware. If this is the case, contact your vendor.

Condition 2.   Error Conditions While Receiving the CDB

Did an error occur while the library was receiving the CDB?

NO

Go to condition 3 (page 3-6).

YES

The library's handling of errors received during the command phase is independent of the requested command. The following errors can occur:

■ **Unsupported Operation (OP) code received**. If the OP code is not supported, the library's response depends on whether the message system is enabled and whether the Group Code is valid. (The Group code is the upper three bits of the first CDB byte; the OP code is the lower five bits of the first CDB byte.) Appendix A describes error handling during the Command phase.

■ **Parity error detected in CDB byte.** If a parity error is detected in a CDB byte, the library's response depends on whether the message system is enabled. Appendix A describes error handling during the Command phase.

Condition 3.   Invalid Logical Unit Number

Was the logical unit number (LUN) in the Identify message non-zero, or if no Identify message was sent, was the LUN in the CDB non-zero?

NO

Go to condition 4 (page 3-8).

YES

See Table 3-1 for information about how the library responds to an invalid LUN for each command.

Table 3-1 Command handling when an invalid LUN has been sent to the library

When the LUN is invalid and you issue this command...	The library does this...		
	Terminates the command and sets sense data.[a] Returns Check Condition status.	Continues processing the command. Sets inquiry data.[b]	Continues processing the command. Sets sense data.[a]
INITIALIZE ELEMENT STATUS (07h)	✔		
INQUIRY		✔	
LOG SENSE	✔		
MODE SELECT	✔		
MODE SENSE	✔		
MOVE MEDIUM	✔		
POSITION TO ELEMENT	✔		
READ ELEMENT STATUS	✔		
RECEIVE DIAGNOSTIC RESULTS	✔		
RELEASE	✔		
REQUEST SENSE			✔
RESERVE	✔		
SEND DIAGNOSTIC	✔		
TEST UNIT READY	✔		

[a] The library sets the sense data as follows: Sense key = Illegal Request (5h), ASC = Logical unit not supported (25h), ASCQ = 0.

[b] The library sets byte 00 in the inquiry data to Invalid Peripheral Byte (7Fh), where the Peripheral Qualifier field (bits 7-5) is 011b and the Peripheral Device Type field (bits 4-0) is 1Fh.

About Logical Unit Numbers

The library supports a logical unit number (LUN) of 0 only. You can specify the LUN in either of two ways:

- By sending an Identify message with the LUN field set to 0
- By sending a CDB with the LUN field set to 0 and not sending an Identify message

If the library is selected with the Attention signal and receives an Identify message during the first Message Out phase, it determines the LUN from the Identify message and ignores the LUN in the CDB. If the library does not receive an Identify message after selection, it uses the LUN in the CDB.

Preservation of Sense Data for LUN 0

To ensure that the initiator receives the correct sense data for the specified LUN, the sense data for LUN 0 is not affected by commands issued to an invalid LUN.

Example—Invalid LUN Sent to the library

1. Initiator 3 selects the library with a LUN of 0 and requests that a cartridge be moved from location 0 to location 3. Location 0 is empty, so the move operation terminates with Check Condition status.

2. Initiator 3 selects the library with a LUN of 2 and issues the REQUEST SENSE command. The following sense data is returned and the command completes with Good status.

Sense Key	Illegal Request (5h)
ASC	Logical Unit Not Supported (25h)
ASCQ	0

3. Initiator 3 selects the library with an LUN of 0 and issues another REQUEST SENSE command. The following sense data is returned and the command completes with Good status.

Sense Key	Illegal Request (5h)
ASC	Move Error (3Bh)
ASCQ	Source for Move Empty (3Dh)

Condition 4. Invalid Initiator Reselection Condition

Has an invalid initiator reselection occurred?

> **Note:** If this condition is true, then the message system must be disabled. If the message system is enabled, invalid initiator reselection was checked before the CDB was received (see page 3-3).

NO

Go to condition 5 (page 3-9).

YES

An invalid initiator reselection condition occurs when the library has disconnected from an initiator to perform a lengthy operation and the same initiator selects the library without Attention. After the library receives the CDB and determines that the command was issued to LUN 0, the library takes the following actions:

1. It aborts the command that it was processing.

2. It returns Check Condition status and sets the sense data as follows:

Sense Key	Aborted Command (Bh)
ASC	Overlapped Commands Attempted (4Eh)
ASCQ	0

Condition 5.   Reservation Conflict Condition

Is the entire library reserved by a different initiator?

> **Note**: Refer to Chapter 15 for more information about the RESERVE command.

NO

Go to condition 6 (page 3-10).

YES

A different initiator has reserved the entire library. See Table 3-2 for command handling.

Table 3-2 Command handling when the library is reserved by a different initiator

When the library is reserved by a different initiator and you issue this command...	The library does this...	
	Terminates the command and returns Reservation Conflict status.	**Continues processing the command.**
INITIALIZE ELEMENT STATUS (07h)	✔	
INQUIRY		✔
LOG SENSE	✔	
MODE SELECT	✔	
MODE SENSE	✔	
MOVE MEDIUM	✔	
POSITION TO ELEMENT	✔	
READ ELEMENT STATUS	✔	
RECEIVE DIAGNOSTIC RESULTS	✔	
RELEASE		✔
REQUEST SENSE		✔
RESERVE	✔	
SEND DIAGNOSTIC	✔	
TEST UNIT READY	✔	

Condition 6.   Busy Condition

Is the library busy?

> **Note**: The library returns Busy status to an initiator when it is disconnected from the SCSI bus to process a SCSI command for a different initiator or aborting a SCSI motion command.

NO

Go to condition 7 (page 3-12).

YES

See Table 3-3 for command handling.

> **Note**: While the library is in the process of aborting a motion command, it returns Busy status to all initiators requesting any command other than INQUIRY (12h) and REQUEST SENSE (03h). This allows the library to complete the abort process as quickly as possible. The library aborts a motion command when it:

Receives an Abort message from the same initiator that requested the command (see Section 1.5 for information about the Abort message.)

After an invalid initiator reselection (see page 3-8)

Table 3-3 Command handling when the library is busy

When the library is busy and you issue this command...	The library does this...	
	Terminates the command and returns Busy status.	**Continues processing the command.**
INITIALIZE ELEMENT STATUS (07h)	✔	
INQUIRY		✔
LOG SENSE	✔	
MODE SELECT	✔	
MODE SENSE	✔	
MOVE MEDIUM	✔	
POSITION TO ELEMENT	✔	
READ ELEMENT STATUS	✔	
RECEIVE DIAGNOSTIC RESULTS	✔	
RELEASE	✔	
REQUEST SENSE		✔
RESERVE	✔	
SEND DIAGNOSTIC	✔	
TEST UNIT READY	✔	

Condition 7.   Pending Unit Attention Condition

Is there a pending Unit Attention condition for the library?

NO

Go to condition 8 (page 3-14).

YES

See Table 3-4 for command handling.

Table 3-4 Command handling when a Unit Attention condition is pending

When the library has a Unit Attention condition pending and you issue this command...	The library does this...	
	Sets sense data for the pending Unit Attention and then clears the Unit Attention. Terminates the command and returns Check Condition status.	Continues processing the command. Reports any pending status. Preserves the pending Unit Attention sense data.
INITIALIZE ELEMENT STATUS (07h)	✔	
INQUIRY		✔
LOG SENSE	✔	
MODE SELECT	✔	
MODE SENSE	✔	
MOVE MEDIUM	✔	
POSITION TO ELEMENT	✔	
READ ELEMENT STATUS	✔	
RECEIVE DIAGNOSTIC RESULTS	✔	
RELEASE	✔	
REQUEST SENSE		✔
RESERVE	✔	
SEND DIAGNOSTIC	✔	
TEST UNIT READY	✔	

About Unit Attention Condition

The library establishes a Unit Attention condition when a user may have accessed the cartridges or tape drive or when any of the library's internal parameters have been changed. Specifically, the library establishes a Unit Attention after any of the following happen:

- The library is reset (whether by a power-on reset, a Bus Device Reset message, a SCSI bus reset, or an operator panel reset).

- The library's firmware is upgraded.

- The data cartridge magazine is replaced (EXB-10e only).

- The library's door is closed.

- The MODE SELECT parameters are changed by an initiator other than the one attempting to communicate with the library.

- LCD text is changed through the CHS Monitor program.

- The library is put in random mode after operating in sequential mode, LCD mode, or CHS Monitor mode (refer to the operating instructions for your library).

For example, the library reports Not Ready when the door is open and Unit Attention as soon as it closes.

First Command Received After Unit Attention Is Reported

If INQUIRY or REQUEST SENSE is the next command received after the Unit Attention condition is reported with Check Condition status, the library sends the sense data for the Unit Attention condition to the initiator and then clears the Unit Attention condition.

If the library receives any other command after reporting the Unit Attention condition, the library clears the sense data for the Unit Attention and executes the command normally.

Reporting of Multiple Unit Attention Conditions

The library does not stack Unit Attention conditions. Whenever there are two or more Unit Attention conditions, the library reports only the last one encountered. For example, if the library is powered on, returned to random mode, and the initiator issues its first SCSI command, the library will only report that the library has just been returned to random mode.

Condition 8.   Unrecoverable Hardware Error Condition

Has an unrecoverable hardware error occurred?

NO

Go to condition 9 (page 3-16).

YES

The library is able to process SCSI commands after an unrecoverable hardware error has occurred unless the failure occurs within the SCSI interface. When the library receives SCSI commands after an unrecoverable hardware error, it processes the commands as described in Table 3-5.

Table 3-5 Command handling when an unrecoverable hardware error has occurred

	The library does this...	
When an unrecoverable hardware error has occurred and you issue this command...	**Sets sense data for the existing hardware error. Terminates the command and returns Check Condition status.**	**Continues processing the command.**
INITIALIZE ELEMENT STATUS (07h)	✔	
INQUIRY		✔
LOG SENSE		
MODE SELECT		✔
MODE SENSE		✔
MOVE MEDIUM	✔	
POSITION TO ELEMENT	✔	
READ ELEMENT STATUS		✔
RECEIVE DIAGNOSTIC RESULTS		✔
RELEASE		✔
REQUEST SENSE		✔
RESERVE		✔
SEND DIAGNOSTIC	✔	
TEST UNIT READY	✔	

About Hardware Error Conditions

A Hardware Error condition occurs when the library detects a failure that prevents it from finishing a requested operation. If the error requires intervention from an operator, the failure is determined to be an *unrecoverable hardware error* and the following occurs:

■ The library displays the error code for the failure on the LCD display

■ The library does not perform motion commands.

For a complete list of hardware error conditions and the sense data set for each, refer to Appendix D.

Clearing an Unrecoverable Hardware Error

To clear an unrecoverable hardware error, do the following:

1. Turn off the power switch.

2. Fix the error. This may involve actions such as removing a data cartridge from the CHM.

3. Turn on the power switch.

The library performs its initialization sequence.

Condition 9. Not Ready Condition

Has a Not Ready condition occurred?

NO

Go to condition 10 (page 3-20).

YES

The library is unable to accept or perform any motion commands. See Table 3-6 for command handling.

Table 3-6 Command handling when the library is Not Ready

When the library is Not Ready and you issue this command...	The library does this...	
	Sets sense data for the Not Ready condition. Terminates the command and returns Check Condition status.	Continues processing the command.
INITIALIZE ELEMENT STATUS (07h)	✔	
INQUIRY		✔
LOG SENSE		✔
MODE SELECT		✔
MODE SENSE		✔
MOVE MEDIUM	✔	
POSITION TO ELEMENT	✔	
READ ELEMENT STATUS	✔	
RECEIVE DIAGNOSTIC RESULTS		✔
RELEASE		✔
REQUEST SENSE		✔
RESERVE		✔
SEND DIAGNOSTIC	✔	
TEST UNIT READY	✔	

About the Not Ready Condition

The library establishes the Not Ready condition when it is unable to accept any motion commands. The library performs all other commands as specified. The library is not ready when:

■ **Its initialization routine is in progress.** Initialization occurs after any of the following:

  - The library is powered on or reset.
  - The front door is closed.

■ **It is operating in sequential, LCD, or CHS Monitor modes**. (Refer to the operating instructions for your library.)

■ **The library door is opened.** When the library door is opened, electric current to all motors is shut off.

■ **The data cartridge magazine is missing.**

■ **The CHM is performing a home operation.** The CHM performs a home operation after every 100 cycles.

The library takes different corrective actions for different types of Not Ready conditions. The following sections describe how the library handles the different Not Ready conditions.

Initialization Process

If a Not Ready condition is caused by a reset condition, the following occurs:

1. The library establishes a Unit Attention condition as a result of the reset and begins its initialization process.

2. During the initialization sequence, the library returns Check Condition status in response to each motion command. If the library receives a REQUEST SENSE command during initialization, it reports the following:

Sense key	Not Ready (2h)
ASC	Not Ready (04h)
ASCQ	Performing power-on self-test (8Ch)

Operating in Sequential, LCD, or CHS Monitor Modes

If a Not Ready condition occurs because the library is operating in sequential, LCD, or CHS Monitor modes, the following occurs:

1. While the library is operating in sequential, LCD, or CHS Monitor modes, it returns Check Condition status in response to each motion command. If the library receives a REQUEST SENSE command, it reports the following:

   CHS Monitor mode:

Sense key	Not Ready (2h)
ASC	Offline (04h)
ASCQ	CHS Monitor mode (89h)

   LCD mode:

Sense key	Not Ready (2h)
ASC	Offline (04h)
ASCQ	LCD mode (8Dh)

   Sequential mode:

Sense key	Not Ready (2h)
ASC	Offline (04h)
ASCQ	Sequential mode (8Eh)

2. When the library is operating in random mode again, it establishes a Unit Attention condition. If the library receives a REQUEST SENSE command, it reports the following:

   CHS Monitor mode:

Sense key	Unit Attention (6h)
ASC	04h
ASCQ	CHS Monitor mode (89h)

   LCD mode:

Sense key	Unit Attention (6h)
ASC	04h
ASCQ	LCD mode (8Dh)

Sequential mode:

Sense key	Unit Attention (6h)
ASC	04h
ASCQ	Sequential mode (8Eh)

Door Open, Cartridge Magazine Missing

If a Not Ready condition occurs because the library's door is open or the data cartridge is missing, the following occurs:

1. If the cartridge magazine is missing, the library reports the following:

Sense key	Not Ready (2h)
ASC	Not Ready (04h)
ASCQ	Data cartridge magazine is missing (86h)

2. Otherwise, while the front door is open, the library returns Check Condition status in response to each motion command. If the library receives a REQUEST SENSE command, it reports the following:

Sense key	Not Ready (2h)
ASC	Not Ready (04h)
ASCQ	Front door is open (85h)

3. After the door is closed, the library begins its initialization process.

4. During its initialization process, the library returns Check Condition status to each motion command. If the library receives a REQUEST SENSE command during initialization, it reports the following:

Sense key	Not Ready (2h)
ASC	Not Ready (04h)
ASCQ	Initialization in Progress (01h)

5. After its initialization process is complete, the library establishes a Unit Attention condition and reports the following in response to a REQUEST SENSE command:

Sense key	Unit Attention (6h)
ASC	Front door was opened then closed (28h)
ASCQ	00h

Condition 10. CDB Reserved Bit Set

Is a reserved bit set (to a value other than 0) in the CDB?

> **Note:** The library checks to make sure all of the reserved bits are set to 0 in the CDB. The reserved bits, if present, are checked from the least significant bit in the least significant byte of the CDB to the most significant bit in the most significant byte of the CDB.

NO

The general command processing for this command completed successfully. For information about the conditions and errors specific to a SCSI command, refer to the section called "Command Execution" in the chapter for that command.

YES

This error is handled in the same manner for every command. The library returns Check Condition status after the first invalid reserved bit is detected. The sense data is set as follows:

Sense Key	Illegal Request (5h)
ASC	Invalid Field in CDB
ASCQ	0
SKSV	1
C/D	1
BPV	1
Bit Pointer	Bit number of invalid reserved bit
Field Pointer	CDB byte number of invalid reserved bit

4 INITIALIZE ELEMENT STATUS (07h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	1	1	1
01	Logical Unit Number			Reserved				
02	Reserved							
03								
04								
05	0	0	Reserved				0	0

4.1   About This Command

The INITIALIZE ELEMENT STATUS command instructs the library to check all elements for the presence of a data cartridge. The library checks the elements in ascending element address order as it performs the pick-and-place cycle at each element location (see Chapter 1 for more information about element addresses). It then stores this information in its cartridge inventory.

To retrieve the results of this command from the cartridge inventory, issue a READ ELEMENT STATUS (B8h) command.

> **Note:**   The EXB-10e cannot detect a data cartridge in the tape drive unless the tape drive's door is open. The EXB-10h can always detect a data cartridge in the tape drive.

When to Use This Command

Use the INITIALIZE ELEMENT STATUS command after a power-up, a power failure, or any manual operation or configuration change that may affect the status of the cartridge inventory.

4.2 Effects on the Cartridge Inventory

The library updates the cartridge inventory after it checks for the presence of a data cartridge at each location. The following list describes how the cartridge inventory is affected depending on the state of the data cartridge magazine and tape drive when you issue an INITIALIZE ELEMENT STATUS command. For more information about the cartridge inventory, see page 2-6.

- If the library completes an INITIALIZE ELEMENT STATUS command successfully, the cartridge inventory is updated for each location as shown in Table 4-1.

Table 4-1 Effect on the cartridge inventory of a cartridge check in a storage location

This cartridge inventory field...	...is changed to the following when...	
	...the location is empty	...the location is full
Occupied	0	1
Occupied Valid	1	1
Source Address	255	*element address**
Source Valid	0	1

* For example, if you are checking slot 2 in the cartridge magazine, the element source address is set to 2.

- If a cartridge has been ejected from the tape drive when you issue an INITIALIZE ELEMENT STATUS command that completes successfully, the cartridge inventory is updated for the tape drive as shown in Table 4-2.

  Note: For the EXB-10e, the tape drive's door is open in this situation and a cartridge may or may not still be present. For the EXB-10h, the cartridge has been ejected from the tape drive and may or may not still be present.

Table 4-2 Effect on the cartridge inventory of a successful cartridge check in a tape drive after the cartridge has been ejected

This cartridge inventory field...	...is changed to the following when the cartridge has been ejected and...	
	...the tape drive is empty	...the tape drive is full
Occupied	0	1
Occupied Valid	1	1
Source Address	255	0
Source Valid	0	1

- If a cartridge has been inserted in the tape drive when you issue an INITIALIZE ELEMENT STATUS command that completes successfully, the cartridge inventory for the tape drive is either updated or not updated as shown in Table 4-3.

Table 4-3 Effect on the cartridge inventory of a successful cartridge check in a tape drive after the cartridge has been inserted

This cartridge inventory field...	...is either changed or not changed as follows for the...		
	EXB-10h	EXB-10e with tape drive door open	EXB-10e with tape drive door closed
Occupied	1	1	unchanged
Occupied Valid	1	1	unchanged
Source Address	0	0	unchanged
Source Valid	1	1	unchanged

4.3   How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from executing. Refer to Chapter 3 for a complete list of conditions that the library checks while it is receiving and after it has received the CDB from the initiator.

Figure 4-1 shows the steps that the library takes when executing the command through the bus free phase.

Note: This section describes the normal processing of the command through the bus free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a message out phase.
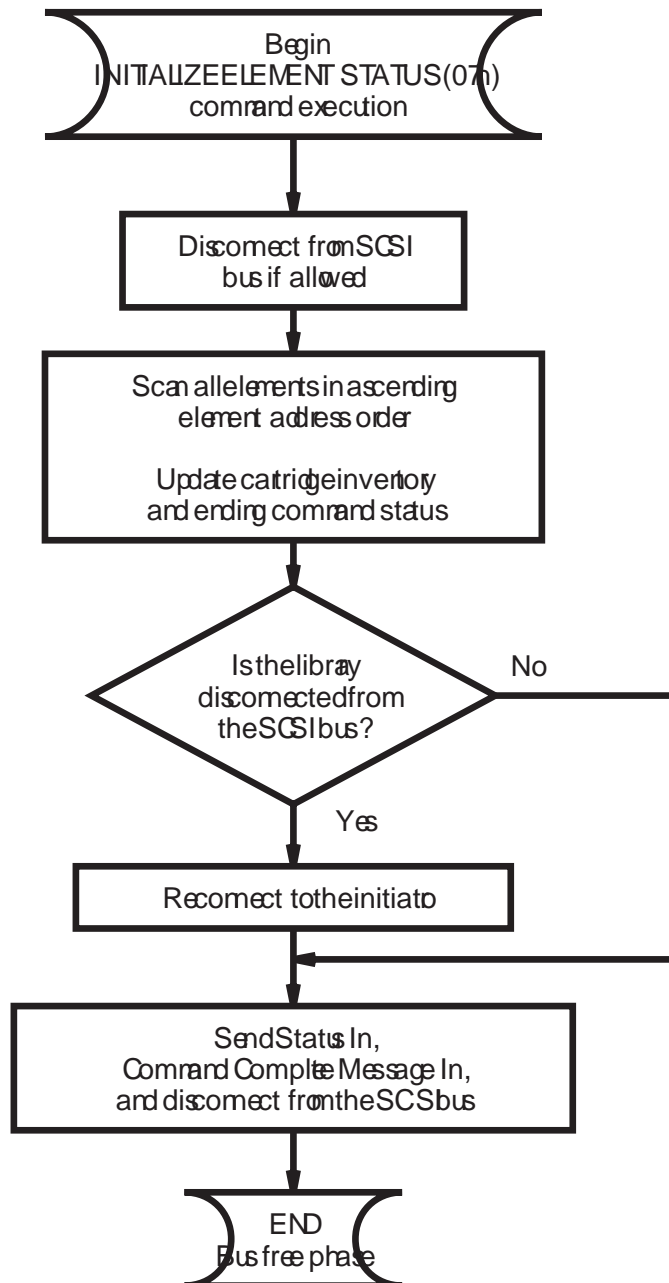
Figure 4-1 INITIALIZE ELEMENT STATUS command execution

4.4 Command Status

The library returns a status byte after processing the INITIALIZE ELEMENT STATUS command.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 15 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.

- The library detects a parity error while receiving the CDB and the message system is not enabled.

- The command is issued to an invalid LUN.

- A Unit Attention condition is pending for the initiator.

- The library has experienced an unrecoverable hardware error.

- The CHM contains a cartridge.

- The library is not ready because the door is open, or it is operating in sequential mode, LCD mode, or CHS Monitor mode.

- A reserved bit is set to 1 in the CDB.

- The library encounters a problem while checking for cartridges.

5 INQUIRY (12h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	0	1	0
01	Logical Unit Number			Reserved				EVPD
02	Page Code							
03	Reserved							
04	Allocation Length							
05	0	0	Reserved				0	0

5.1 About This Command

The INQUIRY command requests that the library send information regarding its parameters to the initiator.

Typical inquiry data looks like this:

```
08h 80h 02h 02h 33h 00h 00h 00h
E X A B Y T E ₋
E X B - 1 0 e ₋ ₋ ₋ ₋ ₋ ₋ ₋ ₋ ₋
3 . 1 ₋
₋ ₋ ₋ ₋ ₋ ₋ ₋ ₋ ₋ ₋ ₋ ₋ ₋ ₋ ₋ ₋ ₋ ₋ ₋
```

Each "₋" indicates an ASCII space character. The inquiry data that the library returns is described in Section 5.3.

5.2　What You Send to the Library

EVPD (Enable Vital Product Data) - Byte 01, Bit 0

This field indicates the type of inquiry data you are requesting. The value for this field must be 0.

Page Code - Byte 02

The value for this field must be 0, since the library supports only a value of 0 for the EVPD field.

Allocation Length - Byte 04

This field specifies the number of bytes that the initiator has allocated for data returned from the INQUIRY command. A value of 0 indicates that no inquiry data is to be transferred. This condition is not an error. If you want the library to return all of its inquiry data, specify an allocation length of 38h (56) bytes (see Section 5.3).

The library terminates the data in phase when it has transferred either the number of bytes specified by the Allocation Length field or all of the available inquiry data, whichever is less.

5.3 What the Library Returns

In response to the INQUIRY command, the library returns 56 bytes of inquiry data, as described below.

Standard Inquiry Data

Bit Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	RMB	Device Type Qualifier						
02	ISO Version		ECMA Version			ANSI (Approved Version)		
03	AENC	TrmIOP	Reserved		Response Data Format			
04	Additional Length							
05	Reserved							
06								
07	RelAdr	WBus32	WBus16	Sync	Linked	RSVD	CmdQue	SftRe
08 ⋮ 15	(MSB) Vendor Identification (LSB)							
16 ⋮ 31	(MSB) Product Identification (LSB)							
32 ⋮ 35	(MSB) Firmware Revision Level (LSB)							
36 ⋮ 55	(MSB) Vendor Specific (LSB)							

Peripheral Qualifier - Byte 00, Bits 7 through 5

The value returned for this field is 0, indicating that the library is a single LUN device. If you specify a LUN other than 0 when you issue this command, the value returned for this field is 011b (binary), which indicates that the library is not capable of supporting a physical device on the specified logical unit.

Peripheral Device Type - Byte 00, Bits 4 through 0

The value returned for this field is 08h, identifying the library as a sequential access medium changer device. If you specify a LUN other than 0 when you issue this command, the value returned for this field is 1Fh, indicating that the peripheral device type is unknown. The remainder of the standard inquiry data is returned normally for the library.

RMB (Removable Medium Bit) - Byte 01, Bit 7

The value returned for this field is 1, indicating that the media is removable.

Device Type Qualifier - Byte 01, Bits 6 through 0

The value returned for this field is 00h, indicating that there are no qualifiers.

Standards Versions - Byte 02

The value returned for this byte is 02h, indicating support of the current ANSI version of the SCSI-2 specification.

AENC (Asynchronous Event Notification Capability) - Byte 03, Bit 7

The value returned for this field is 0, indicating that the library does not support this function.

TrmIOP (Terminate I/O Process) - Byte 03, Bit 6

The value returned for this field is 0, indicating that the library does not support this function.

Response Data Format - Byte 03, Bits 3 through 0

The value returned for this field is 2h, indicating that the data found is in accordance with SCSI-2.

Additional Length - Byte 04

The value returned for this field is 33h, indicating that there are 33h (51) additional bytes of inquiry data available to be returned to the initiator. These bytes are defined below.

RelAdr (Relative Addressing) - Byte 07, Bit 7

The value returned for this field is 0, indicating that the library does not support this function.

WBus32 (Wide Bus 32) - Byte 07, Bit 6

The value returned for this field is 0, indicating that the library does not support 32-bit-wide bus transfers.

WBus16 (Wide Bus 16) - Byte 07, Bit 5

The value returned for this field is 0, indicating that the library does not support 16-bit-wide bus transfers.

Sync (Synchronous Transfer) - Byte 07, Bit 4

The value returned for this field is 0, indicating that the library does not support synchronous data transfer.

Linked (Linked Command) - Byte 07, Bit 3

The value returned for this field is 0, indicating that the library does not support linked commands.

CmdQue (Command Queuing) - Byte 07, Bit 1

The value returned for this field is 0, indicating that the library does not support tag command queuing.

SftRe (Soft Reset) - Byte 07, Bit 0

The value returned for this field is 0, indicating that the library does not support the soft reset alternative in response to a reset condition.

Vendor Identification - Bytes 08 through 15

The value contained in these bytes is the ASCII representation of "EXABYTE" followed by a single space.

Product Identification - Bytes 16 through 31

The value contained in these bytes is the ASCII representation of the product name, "EXB-10e" followed by spaces. Note that the EXB-10h also returns the product name "EXB-10e."

> **Note:** If the library is in EXB-10i emulation mode (set through the operator panel or the MODE SELECT command), the library returns "EXB-10i" instead of "EXB-10e" for the Product Identification.

Firmware Revision Level - Bytes 32 through 35

The value contained in these bytes is the ASCII representation of the firmware revision level (for example, "3.1 " or other Exabyte firmware revisions).

Vendor Specific - Bytes 36 through 55

The value contained in these bytes is the ASCII representation of blanks. This field is reserved for future implementation.

5.4   How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 5-1 shows the steps that the library takes when executing the command through the bus free phase. As shown in the figure, the library validates the parameters in the CDB. Table 5-1 shows the sense data reported for invalid parameters in the CDB.

Note: This section describes the normal processing of the command through the bus free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a message out phase.

```
        ┌─────────────────┐
        │      Begin       │
        │  INQUIRY (12h)   │
        │ command execution│
        └─────────────────┘
                 │
                 ▼
          ╱Are the parameters╲   No    ┌──────────────────────────────┐
         ╱  in the CDB valid? ╲───────▶│  Set Check Condition status  │
         ╲                    ╱         │ and set sense data to indicate│
          ╲                  ╱          │ first invalid parameter detected│
                 │ Yes               └──────────────────────────────┘
                 ▼
          ╱                  ╲   Yes   ┌──────────────────┐
         ╱ Does Allocation Length = 0? ╲──────▶│ Set status to Good │
         ╲                  ╱         └──────────────────┘
                 │ No
                 ▼
        ┌─────────────────┐
        │ Prepare inquiry data │
        └─────────────────┘
                 │
                 ▼
          ╱            ╲   Yes
         ╱ Does LUN = 0? ╲──────────▶
         ╲            ╱
                 │ No
                 ▼
   ┌──────────────────────────────────┐
   │ Set the Peripheral Qualifier to indicate that │
   │  the library is not capable of supporting a   │
   │  physical device on the specified logical unit │
   └──────────────────────────────────┘
                 │
                 ▼
   ┌──────────────────────────────┐
   │ Set the Peripheral Device Type to indicate │
   │ that the peripheral device type is unknown │
   └──────────────────────────────┘
                 │
                 ▼
   ┌──────────────────────────────┐
   │            Data In phase:            │
   │   send the inquiry data to the initiator │
   │ (the number of bytes returned is 56 bytes │
   │  or the Allocation Length, whichever is less) │
   └──────────────────────────────┘
                 │
                 ▼
   ┌──────────────────────────────┐
   │          Send Status In,          │
   │  Command Complete Message In,     │
   │  and disconnect from the SCSI bus │
   └──────────────────────────────┘
                 │
                 ▼
        ┌─────────────────┐
        │       END        │
        │  Bus free phase  │
        └─────────────────┘
```

Figure 5-1 INQUIRY command execution

5.5 Command Status

The library returns a status byte after processing the INQUIRY command.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library never returns Busy status for the INQUIRY command.

Reservation Conflict

The library never returns Reservation Conflict status for the INQUIRY command.

Check Condition

The library returns Check Condition status for the following reasons:

■ The message system is enabled and a message error occurs while the library is processing the command.

■ The library detects an unrecoverable parity error while receiving the CDB.

■ A reserved bit is set to 1 in the CDB.

■ A parameter in the CDB is invalid (see Table 5-1 for sense data).

Table 5-1 Invalid parameters in the INQUIRY CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	0	0001h	Invalid value in EVPD field.
5h	24h	00h	1	1	0	0	0002h	Invalid Page Code.

6 LOG SENSE (4Dh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	1	0	0	1	1	0	1
01	Logical Unit Number			Reserved			PPC	SP
02	PC		Page Code					
03	Reserved							
04								
05	(MSB)		Parameter Pointer					
06								(LSB)
07	(MSB)		Allocation Length					
08								(LSB)
09	0	0	Reserved				0	0

6.1   About This Command

The LOG SENSE command provides a means for the initiator to retrieve statistical and state information that the library maintains. By using this command, you can receive the following information:

- Library statistics (for example: retry counts, number of picks and places)

- History of recent library events

- State of the library hardware

6.2   What You Send to the Library

PPC (Parameter Pointer Control) - Byte 01, Bit 1

The value for the PPC field must be 0. This directs the library to begin with the parameter code specified in the Parameter Pointer field and return the number of bytes specified in the Allocation Length field in ascending order of parameter codes from the specified log page. When both the PPC bit and the Parameter Pointer field are set to 0, the library returns all available log parameters for the specified log page to the initiator.

SP (Saved Parameters) - Byte 01, Bit 0

The value for the SP field must be 0. This indicates that the library will perform the LOG SENSE command and will not save any log parameters.

PC (Page Control) - Byte 02, Bits 6 and 7

The value for the PC field must always be set to 01b. This indicates that the library will always return the cumulative values for any log parameter requested. The library does not support any threshold values or default cumulative values.

Page Code - Byte 02, Bits 0 through 5

The Page Code field allows you to identify which page of data is being requested. The value for this field must be one of the values specified in Table 6-1. If it is not, the library terminates the command with Check Condition status and sets the sense key to Illegal Request with the additional sense code set to Invalid Field in CDB.

Table 6-1 Valid values for the Page Code field

Page Code	Page Name	Description
00h	Supported Log Pages	Returns a list of supported log pages.
30h	System Statistics Log	Returns system statistics and retry counts.
31h	State Log	Returns the hardware state of the library, which includes the state of library sensors and the CHM position.
32h	History of Events Log	Returns a history of the most recent events that occurred during the operation of the library.

Parameter Pointer - Bytes 05 and 06

The Parameter Pointer field allows you to request parameter data beginning from a specific parameter code to the maximum allocation length or the maximum parameter code supported by the library, whichever is less. If the value of the parameter pointer field is larger than the largest available parameter code that the target can return on the specified page, the library terminates the command with Check Condition status and sets the sense key to Illegal Request and the additional sense code to Invalid Field in CDB.

Notes:

- Log parameters within the specified log page will be transferred in ascending order according to the parameter code.

- When the Page Code field is set to 00h, the Parameter Pointer field must also be set to 0, indicating that you are requesting the Supported Log Pages page (00h), which lists all log pages.

- The Parameter Pointer field can be set to a negative number.

Allocation Length - Bytes 07 and 08

The Allocation Length field allows you to determine the maximum amount of data to be transferred from the library to the initiator. If you specify an allocation length that is greater than the bytes available, the library will terminate the Data In phase when all bytes have been transferred. You can specify FFFFh to include all available data.

6.3   What the Library Returns

This section describes the log page structure and the log pages that the library supports. The LOG SENSE command returns a single log page specified in the page code field of the CDB. Each log page begins with a four-byte page header (bytes 00 through 03), followed by zero or more variable-length log parameters defined for that page. The log page format is defined below.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Reserved							
02	(MSB)		Page Length (n–3)					
03								(LSB)
04 ⋮ n	Log Parameter (First) ⋮ Log Parameter (Last)							

Page Code - Byte 00, Bits 0 through 5

The Page Code field identifies which log page is being transferred. This field contains one of the codes described in the Table 6-1.

Page Length - Bytes 02 and 03

The Page Length field indicates the total number of bytes that follow this byte. The value returned for this field depends on the value you specified for the Page Code and the Parameter Pointer in the CDB. This value is independent of what you specified for the Allocation Length.

Log Parameters (First and Last) - Bytes 04 through n

Log parameters are data structures that are contained in log pages and can be one of the following:

- Data counters that record a count of a particular event
- A numeric value indicating the state of the library hardware
- A string that contains the library event history

Log Parameter Format

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)			Parameter Code				
01								(LSB)
02	DU	DS	TSD	ETC	TMC		RSVD	LP
03	Parameter Length (*n*–3)							
04	Parameter Value							
n								

Each log parameter begins with a four-byte header followed by one or more bytes of parameter value data. The fields in the log parameter are described below.

Parameter Code - Bytes 00 and 01

The Parameter Code field identifies which log parameter is being transferred for that log page. The valid values for this field depend on the type of log page the library is returning, as described later in this chapter.

Parameter Control (DU, DS, TSD, ETC, TMC, LP) - Byte 02

The Parameter Control field consists of the following bits:

DU - Disable Update   This bit indicates when the log parameter is updated:

0 – The library will update the log parameter value to reflect all events that should be noted by that parameter.

1 – The library will not update the log parameter, except when another LOG SENSE command is issued that has a new value for that parameter.

DS - Disable Save   This bit indicates whether the library supports saving for the log parameter:

0 – The library supports saving for the log parameter.
1 – The library does not support saving for the log parameter.

TSD - Target Save Disable   This bit is always 0, which indicates that the library provides a self-defined method for saving log parameters.

ETC - Enable Threshold Comparison   This bit is always 0, which indicates that a comparison to the threshold value is not performed whenever the cumulative value is updated.

TMC - Threshold Met Criteria   This bit is always 0 and defines the basis for comparison of the cumulative and threshold values.

LP - List Parameter   The List Parameter bit indicates the format of the log parameter:

0 – The parameter is a data counter.
1 – The parameter is a list parameter.

Parameter Length - Byte 03

The Parameter Length field specifies the length in bytes of the following parameter value. If the initiator sends an allocation length value that truncates the parameter value, the library terminates the command with Check Condition status and sets the sense key to Illegal Request with the additional sense code set to Invalid Field in Parameter List.

Parameter Value - Bytes 04 through *n*

The parameter value can be one of the following:

- A data counter for an library event, which can be either a four-byte or two-byte value.

- A value that indicates the state of a certain part of the library hardware. If this field is 1, the state of the part is on. If this field is 0, the state of the part is off.

- A string that describes an library history event.

The following sections describe all log parameters that the library supports.

Supported Log Pages Page (Page Code 00h)

The Supported Log Pages page lists all log pages that the library supports. The format for this log page is shown below.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (00h)					
01	Reserved							
02	Page Length (4h)							
03								
04	00h (Supported Log Page)							
05	30h (System Statistics Log Page)							
06	31h (State Log Page)							
07	32h (History of Event Log Page)							

System Statistics Log Page (Page Code 30h)

The System Statistics Log page returns library system statistics, which include the number of picks, places, moves, cartridge inserts, homes executed, and retry counts.

Saved Library Statistics

Log parameters with a parameter code of 0 through 99 correspond to system statistics that the library keeps in nonvolatile RAM. The library remembers these statistics over power cycles: Table 6-2 summarizes these log parameters.

Table 6-2 System statistics (saved in nonvolatile RAM)

Log Parameter Function	Log Parameter Code	Parameter Control Byte						Parameter Length
		DU	DS	TSD	ETC	TMC	LP	
Number of Picks	0	0	0	0	0	0	0	2
Number of Places	1	0	0	0	0	0	0	2
Number of Tape Drive Cartridge Inserts (Tape Drive Door Closures for the EXB-10e	2	0	0	0	0	0	0	2
Number of Y Axis Moves	3	0	0	0	0	0	0	4
Number of Y Axis Homes	4	0	0	0	0	0	0	2
Number of Z Axis Homes	5	0	0	0	0	0	0	2
Power On Minutes	6	0	0	0	0	0	0	4

Nonsaved Library Statistics

Log parameters that are not saved in the library nonvolatile RAM are library retry counts. These counts are reset to zero whenever one of the following occurs:

- The library is turned off and then on (power cycle)
- The SCSI bus is reset
- A Bus Device Reset message is received from the SCSI bus
- The library is reset

Table 6-3 summarizes these counts.

> **Note:** If the library is in EXB-10i emulation mode (see page 7-11) and receives a LOG SENSE command requesting log parameter codes 117 and 118, the library returns only log parameter 117. While the library is in EXB-10i emulation mode, log parameter 117 is the sum of the Inner Slot Pick Retries and the Outer Slot Pick Retries. This corresponds to the EXB-10i's log parameter 117 which is Slot Pick Retries. You can obtain the Outer Slot Pick Retries value by issuing a separate LOG SENSE command to return log parameter 118.

Table 6-3 System statistics (not saved in nonvolatile RAM)

Log Parameter Function	Log Parameter Code	Parameter Control Byte						Parameter Length
		DU	DS	TSD	ETC	TMC	LP	
Pick Retry (Tape Drive)	100	1	1	0	0	0	0	2
Pick Retry (Zero to Slowdown)	101	1	1	0	0	0	0	2
Pick Retry (Slowdown to Pick)	102	1	1	0	0	0	0	2
Place Retry (Solenoid)	103	1	1	0	0	0	0	2
Place Retry (Eject)	104	1	1	0	0	0	0	2
Place Retry (Droop)	105	1	1	0	0	0	0	2
Place Retry (Droop Catch)	106	1	1	0	0	0	0	2
Place Retry (Clear Solenoid)	107	1	1	0	0	0	0	2
Tape Drive Cartridge Insert Retry (Tape Drive Door Close Retry for the EXB-10e)	108	1	1	0	0	0	0	2
Home Z Retries	109	1	1	0	0	0	0	2
Move Y Retries	110	1	1	0	0	0	0	2
Picks from tape drive that required no retries	111	1	1	0	0	0	0	2
Picks from tape drive that required 1 retry	112	1	1	0	0	0	0	2
Picks from tape drive that required 2 retries	113	1	1	0	0	0	0	2
Picks from tape drive that required 3 retries[a]	114	1	1	0	0	0	0	2
Picks from tape drive that required 4 retries[a]	115	1	1	0	0	0	0	2
Horizontal Axis Corrections	116	1	1	0	0	0	0	2
Inner Slot Pick Retries[b]	117	1	1	0	0	0	0	2
Outer Slot Pick Retries[b]	118	1	1	0	0	0	0	2

[a] The EXB-10h returns all zeros for this parameter.

[b] When EXB-10i emulation is on, log parameter 117 is the sum of the Inner Slot Pick Retries and the Outer Slot Pick Retries. Log parameter 118 is not returned.

State Log Page (Page Code 31h)

When you request the State Log page, the library returns log parameters that indicate the current state of the library hardware.

Library Sensors Log Parameters

Log parameter codes 00 through 07 indicate the state of the library sensors. For each sensor in the library, there is a corresponding log parameter. The values of the log parameter indicate whether the sensor is on or off. The Parameter Value field contains a 1 if the sensor corresponding to the log parameter is on; or it contains a 0 if the sensor corresponding to the log parameter is off.

Table 6-4 indicates the value of the Parameter Code, Parameter Length, DU, DS, TSD, ETC, TMC, and LP fields in the log parameter.

Table 6-4 Log parameters for library sensors

Log Parameter Function	Log Parameter Code	Parameter Control Byte						Parameter Length
		DU	DS	TSD	ETC	TMC	LP	
Cartridge Present Sensor	0	1	1	0	0	0	0	1
Data Cartridge Magazine Sensor	1	1	1	0	0	0	0	1
Tape Drive Unload (Tape Drive Door for the EXB-10e)	2	1	1	0	0	0	0	1
Library Door	3	1	1	0	0	0	0	1
Reserved	4	1	1	0	0	0	0	1
Reserved	5	1	1	0	0	0	0	1
Y Home Sensor	6	1	1	0	0	0	0	1
Z Home Sensor	7	1	1	0	0	0	0	1

Library Mechanism Position Log Parameters

Log parameter codes 100 and 101 indicate the physical position of the cartridge handling mechanism (CHM). This position will be a four-byte number. Table 6-5 below summarizes the log parameters for the mechanism position.

Table 6-5 Log parameters for the library mechanism position

Log Parameter Function	Log Parameter Code	Parameter Control Byte						Parameter Length
		DU	DS	TSD	ETC	TMC	LP	
Y Axis Position	100	1	1	0	0	0	0	4
Z Axis Position	101	1	1	0	0	0	0	4

Home Frequency Log Parameter

Log parameter code 200 indicates the frequency of the library's home operations. This number represents the number of tape drive cartridge inserts (tape drive door closures for the EXB-10e) that occurred between successive home operations. Table 6-6 summarizes the log parameters for home frequency operations.

Table 6-6 Log parameters for home frequency operations

Log Parameter Function	Log Parameter Code	Parameter Control Byte						Parameter Length
		DU	DS	TSD	ETC	TMC	LP	
Home Frequency. (EXB-10h: The number of tape drive cartridge inserts between successive autohome functions. EXB-10e: The number of tape drive door closures between successive autohome functions.)	200	1	1	0	0	0	0	2

History of Events Log Page (Page Code 32h)

The History of Events Log page returns a history of recent events that occurred in the library. Each of the library's events is a string that consists of two fields:

- A description of the event
- A time stamp indicating the time and date the event occurred

Each event is 80 bytes of ASCII characters. The first 56 characters provide a description of the event. The last 17 characters are a time stamp string indicating the time and date the event occurred.

Each log parameter for this page code has the following format:

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)			Parameter Code				
01								(LSB)
02	1	1	0	0	0		RSVD	1
03	Parameter Length (50h)							
04 ⋮ 83	*80 characters of event*							

The Parameter Code field indicates the index of the history record: 0 is the index of the most recent event, –1 is the index of the next most recent, and so on. The library keeps 100 of the most recent events (indexed 0 through –99).

The event history that the library maintains includes information about SCSI commands and phases, motion commands, retries and errors, diagnostics, and system status.

6.4   How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 6-1 shows the steps that the library takes when executing the command through the bus free phase. As shown in the figure, the library validates the parameters in the CDB. Table 6-7 shows the sense data reported for invalid parameters in the CDB.

> **Note:**   This section describes the normal processing of the command through the bus free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a message out phase.

```
        ┌─────────────────────────┐
        │         Begin           │
        │ LOG SENSE (4Dh) command │
        │       execution         │
        └─────────────────────────┘
                    │
                    ▼
              ╱───────────╲                        ┌──────────────────────────┐
             ╱  Are the     ╲          No          │  Set Check Condition      │
            ╱  parameters     ╲ ──────────────────▶│  status and set sense     │
            ╲  in the CDB      ╱                    │  data to indicate first   │
             ╲  valid?       ╱                      │  invalid parameter        │
              ╲───────────╱                         │  detected                 │
                    │                               └──────────────────────────┘
                  Yes                                           │
                    ▼                                           │
        ┌─────────────────────────┐                            │
        │    Prepare requested     │                           │
        │      log page data       │                           │
        └─────────────────────────┘                            │
                    │                                           │
                    ▼                                           │
        ┌─────────────────────────┐                            │
        │  Data In phase: send the │                           │
        │  log page data to the    │                           │
        │  initiator. The library  │                           │
        │  returns the complete    │                           │
        │  log page or the number  │                           │
        │  of bytes specified with │                           │
        │  the Allocation Length,  │                           │
        │  whichever is less.      │                           │
        └─────────────────────────┘                            │
                    │                                           │
                    ▼◀──────────────────────────────────────────
        ┌─────────────────────────┐
        │     Send Status In,      │
        │  Command Complete Message │
        │  In, and disconnect from  │
        │     the SCS bus          │
        └─────────────────────────┘
                    │
                    ▼
        ┌─────────────────────────┐
        │          END            │
        │      Bus free phase     │
        └─────────────────────────┘
```
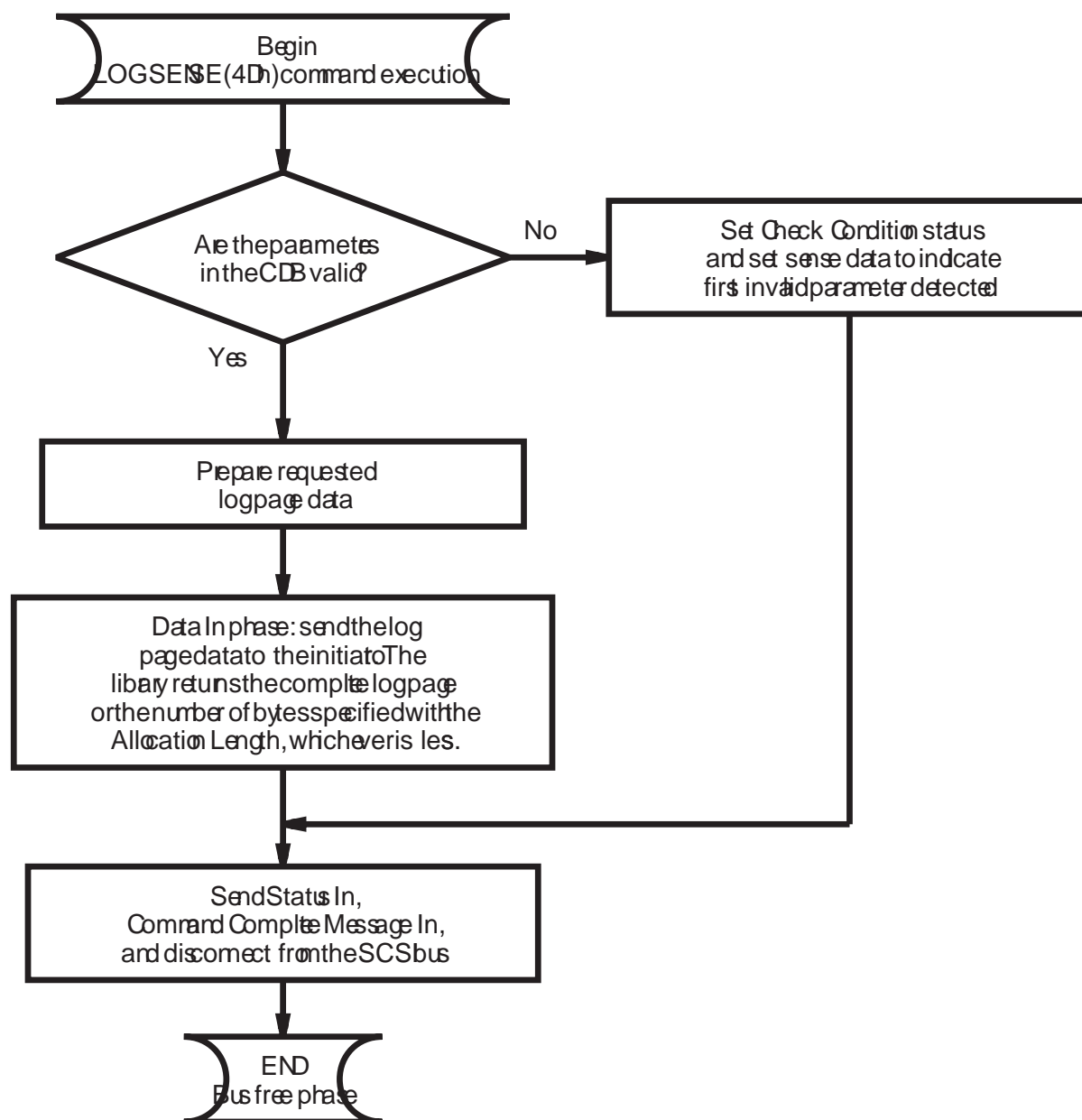
Figure 6-1 LOG SENSE command execution

6.5   Command Status

The library returns a status byte after processing the LOG SENSE command.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 15 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.

- The library detects an unrecoverable parity error while receiving the CDB.

- The command is issued to an invalid LUN.

- A Unit Attention condition is pending for the initiator.

- A reserved bit is set to 1 in the CDB.

- A parameter in the CDB is invalid (see Table 6-7 for sense data).

Table 6-7 lists errors for the LOG SENSE command.

Table 6-7 Invalid parameters in the LOG SENSE CDB

Sense Key	ASC	ASCQ	SKSV	C/D	BPV	Bit Pointer	Field Pointer	Error Description
5h	24h	0h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	0h	1	1	1	7	0002h	The PC field is incorrect. It must be set to 01b.
5h	24h	0h	1	1	1	5	0002h	Invalid page code.
5h	24h	0h	1	1	0	0	0005h	Invalid parameter pointer.

7 MODE SELECT (15h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	0	1
01	Logical Unit Number			PF	Reserved			SP
02	Reserved							
03	Reserved							
04	Parameter List Length							
05	0	0	Reserved				0	0

7.1   About This Command

The MODE SELECT command enables you to specify operating parameters for the library. These parameters configure the library upon power-up, a SCSI bus reset, or receipt of a Bus Device Reset message. You provide the parameters in a parameter list that can include the following:

- 4 bytes for the Parameter List Header (required)
- 20 bytes for the Element Address Assignment page
- 4 bytes for the Baud Rate page
- 84 bytes for the LCD Mode page
- 6 bytes for the Sequential Option page
- 4 bytes for the Parity page

The values sent to the library apply to all initiators in a multi-initiator environment. If an initiator issues a MODE SELECT command that changes any parameters, the library returns a Check Condition status with a sense key of Unit Attention (6h) and an ASC and ASCQ of Mode Parameters Changed (2Ah and 01h, respectively) to all other initiators that issue a request to the library.

Notes:

- Before issuing any MODE SELECT commands, issue a MODE SENSE (1Ah) command with the PC field set to 1h and the Page Code field set to 3Fh to determine which pages of mode parameters are supported, which parameters within the pages are changeable, and the supported length of each page. See Chapter 8 for more information about the MODE SENSE command.

- When you issue a MODE SELECT command, the parameters are not changed until the library has verified that the new values are valid. If a value is not valid, the library returns the appropriate error (see Section 7.4) and does not change the MODE SELECT parameters.

7.2   What You Send to the Library

PF (Page Format) - Byte 01, Bit 4

This field specifies the page format used by the library. The library supports the page format specified by SCSI-2. This value must be 1.

SP (Saved Page) - Byte 01, Bit 0

The library supports the saved page function. The values for this field are as follows:

0 – Current configuration values are changed to the values sent to the library. Saved values stored in nonvolatile memory are not affected.

1 – Current configuration values specified by this command are saved in nonvolatile memory and used for subsequent operations.

Parameter List Length - Byte 04

This field indicates the length of the entire parameter list. The parameter list length is equal to the sum of the length of one Parameter List Header (4 bytes) plus the lengths of all pages to be transferred. Table 7-1 lists the page lengths. If no pages are to be transferred, specify 0 for the Parameter List Length field.

> **Note:** A parameter list length of 4 is not valid. When you send the Parameter List Header, you must send at least one page with it.

Table 7-1 MODE SELECT page lengths

Page	Length (in bytes)
Element Address Assignment page	20 (14h)
Baud Rate page	4 (04h)
LCD Mode page	84 (54h)
Sequential Option page	6 (06h)
Parity page	4 (04h)

For example, if you want to transfer the Parity page, set the parameter list length to 8 (08h):

```
   4 bytes   (Parameter List Header length)
 + 4 bytes   (Parity page length)
   8 bytes
```

If you want to transfer the Element Address Assignment page, Baud Rate page, and LCD Mode page, set the parameter list length to 112 (70h):

```
    4 bytes   (Parameter List Header length)
   20 bytes   (Element Address Assignment page length)
    4 bytes   (Baud Rate page length)
 + 84 bytes   (LCD Mode page length)
  112 bytes
```

Parameter List Header

This section describes the fields for the Parameter List Header and the values you can specify for these fields. Do not send the Parameter List Header if you are sending no parameter pages.

Bit Byte	7	6	5	4	3	2	1	0
00								
01				Reserved				
02								
03								

All fields of the Parameter List Header are reserved. You must specify a value of 0 for each field.

Element Address Assignment Page (1Dh)

Refer to "Assigning Element Addresses" on page 7-6, and to Figure 7-1 on page 7-7 for the default element address assignments.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved			Page Code (1Dh)				
01	Parameter List Length							
02	(MSB)		Medium Transport Element Address					
03								(LSB)
04	(MSB)		Number of Medium Transport Elements					
05								(LSB)
06	(MSB)		First Storage Element Address					
07								(LSB)
08	(MSB)		Number of Storage Elements					
09								(LSB)
10	(MSB)		First Import/Export Element Address					
11								(LSB)
12	(MSB)		Number of Import/Export Elements					
13								(LSB)
14	(MSB)		First Data Transfer Element Address					
15								(LSB)
16	(MSB)		Number of Data Transfer Elements					
17								(LSB)
18	Reserved							
19								

Parameter List Length - Byte 01

This field indicates the length of the element address assignment parameter list. The valid value for this field is 18 (12h), which indicates that there are an additional 18 bytes of parameter data that follow this byte.

Medium Transport Element Address - Bytes 02 and 03

This field identifies the address of the cartridge handling mechanism (CHM). The default value for this field is 0Bh (11).

Number of Medium Transport Elements - Bytes 04 and 05

This field identifies the number of CHMs within the library. The library has only one CHM. The valid value for this field is 1.

First Storage Element Address - Bytes 06 and 07

This field identifies the starting address of the data cartridge storage locations. The default starting address is 1.

Number of Storage Elements - Bytes 08 and 09

This field identifies the number of data cartridge storage locations within the library. The total number of data cartridge storage locations is 10. The valid value for this field is 0Ah (10).

First Import/Export Element Address - Bytes 10 and 11

This field identifies the address of the import/export element. Since the library does not have an import/export element, the value for this field must be 0.

Number of Import/Export Elements - Bytes 12 and 13

This field identifies the total number of locations used for importing and exporting data cartridges to and from the data cartridge storage area. Since the library does not have an import/export element, the value for this field must be 0.

First Data Transfer Element Address - Bytes 14 and 15

This field identifies the address of the installed tape drive. The library can have only one tape drive installed. The default starting address is 0.

Number of Data Transfer Elements - Bytes 16 and 17

The library can have one tape drive installed. The value for this field must be 1.

Assigning Element Addresses

An *element* is a way of classifying various components in the library. Element addresses reference specific physical locations in the library. The library contains three element types: the CHM, cartridge slots, and the tape drive (known as the medium transport, storage, and data transfer elements, respectively). Each element requires an address so that it can be identified during a SCSI command operation. The library has default addresses assigned to each element, as shown in Figure 7-1.

Cartridge Slots   **CHM**

Cartridge Slots	CHM
10	11
9	
8	
7	
6	
5	
4	
3	
2	
1	

Tape Drive

Tape Drive
0

Figure 7-1 Default element address assignments

If you want to change the addresses of the library's elements, use the Element Address Assignment page. In this page, you assign a starting address for each element type (CHM, data cartridge slots, and tape drive) and then specify the total number of elements of that type. Since there is only one tape drive and one CHM, the starting addresses you specify will be the *only* addresses for these two elements. The element addresses for the cartridge slots will be numbered consecutively, with the first address for that type being the starting element address that you specify.

► **Important** For the starting element addresses, you can specify any 16-bit binary number, with the following exceptions:

Element addresses must not overlap.

Addresses for the storage elements must be consecutive. The highest address you can assign for the first storage element is FFF6h. (This causes the last storage element to be numbered FFFFh).

Since the library supports the saved page function, you can save the element address values you send to the library by setting the SP bit in the CDB to 1. These values configure the library upon power-up, a SCSI bus reset, or receipt of a Bus Device Reset message.

Baud Rate Page (20h)

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (20h)					
01	Parameter List Length							
02	(MSB)		Baud Rate					
03								(LSB)

Parameter List Length - Byte 01

This field indicates the length of the baud rate parameter list. The Parameter List Length is 02h, which indicates that there are two additional bytes of parameter data that follow this byte.

Baud Rate - Bytes 02 and 03

This field specifies the baud rate that should be used for the diagnostic port. The library supports the following values:

- 300
- 1200
- 2400
- 4800
- 9600
- 19200

This feature is factory set in nonvolatile memory. The factory default is 9600.

LCD Mode Page (22h)

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved			Page Code (22h)				
01	Parameter List Length							
02	Reserved				Write Line 1	Write Line 2	Write Line 3	Write Line 4
03	Reserved							
04 ⋮ 23	Display Line 1							
24 ⋮ 43	Display Line 2							
44 ⋮ 63	Display Line 3							
64 ⋮ 83	Display Line 4							

Parameter List Length - Byte 01

This field indicates the length of the LCD Mode page. The valid value for this field is 82 (52h), which indicates that 82 bytes of data follow this byte.

Write Line 1 - Byte 02, Bit 3

This field controls the text for Line 1 of the display, as follows:

0 – Library internal text, for example "Exabyte EXB-10h" or "Exabyte EXB-10e"

1 – Text you specified in bytes 4 through 23 of the LCD Mode page

Write Line 2 - Byte 02, Bit 2

This field controls the text for Line 2 of the display, as follows:

0 – Library internal text, for example, "VER *x.yy.zz hh:mm:ss*," where *hh:mm:ss* is the current time in hours, minutes, and seconds.

1 – Text you specified in bytes 24 through 43 of the LCD Mode page

Write Line 3 - Byte 02, Bit 1

This field controls the text for Line 3 of the display, as follows:

0 – Library internal text, for example, a high-level status message
1 – Text you specified in bytes 44 through 63 of the LCD Mode page

Write Line 4 - Byte 02, Bit 0

This field controls the text for Line 4 of the display, as follows:

0 – Library internal text, for example, a low-level status message
1 – Text you specified in bytes 64 through 83 of the LCD Mode page

Display Line 1 - Bytes 04 through 23

This field enables you to specify text to appear on Line 1 of the LCD. You can use up to 20 characters for this text. If you use less than 20 characters, at least one byte following the text must be a 00h.

> **Note:**   Refer to Appendix C for the LCD character set for the Display Line fields.

Display Line 2 - Bytes 24 through 43

This field enables you to specify text to appear on Line 2 of the LCD. You can use up to 20 characters for this text. If you use less than 20 characters, at least one byte following the text must be a 00h.

Display Line 3 - Bytes 44 through 63

This field enables you to specify text to appear on Line 3 of the LCD. You can use up to 20 characters for this text. If you use less than 20 characters, at least one byte following the text must be a 00h.

Display Line 4 - Bytes 64 through 83

This field enables you to specify text to appear on Line 4 of the LCD. You can use up to 20 characters for this text. If you use less than 20 characters, at least one byte following the text must be a 00h.

Sequential Option Page (23h)

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (23h)					
01	Parameter List Length							
02	Emu10i	Reserved			S/R	Loop	Restrt	NxtVal
03	(MSB)	Next Cartridge Element Address						
04								(LSB)
05	Reserved							

Parameter List Length - Byte 01

The value for this field is 04h, which indicates that there are four additional bytes of data that follow this byte.

Emu10i - Byte 02, Bit 7

This field specifies whether the library should emulate the EXB-10i when it receives INQUIRY, MODE SENSE, or LOG SENSE command:

0 – Do not emulate the EXB-10i
1 – Emulate the EXB-10i

See Table 8-1 on page 8-15 for information about the library's response to the INQUIRY, MODE SENSE, and LOG SENSE commands when this field is set to 1 (emulate EXB-10i).

S/R - Byte 02, Bit 3

This field specifies which mode the library should operate in:

0 – Random mode
1 – Sequential mode

Loop - Byte 02, Bit 2

When S/R is 1 (sequential mode), this field specifies whether the library should stop processing cartridges after cartridge 10, or loop back to cartridge 1 and continue processing:

0 – Stop after cartridge 10 has been processed
1 – Loop through cartridges continuously

If S/R is 0 (random mode), this field must be 0.

Restrt - Byte 02, Bit 1

When S/R is 1 (sequential mode), this field specifies whether the library should resume processing with cartridge 1 after a reset or power cycle, or whether it should resume processing at the point it left off:

0 – Resume processing where interrupted
1 – Resume processing with cartridge 1

If S/R is 0 (random mode), this field must be 0.

NxtVal - Byte 02, Bit 0

This field specifies whether the Next Cartridge Element Address field (bytes 03 and 04) is valid:

0 – Ignore the Next Cartridge Element Address field
1 – Next Cartridge Element Address field is valid

If S/R is 0 (random mode), this field must be 0.

Next Cartridge Element Address - Bytes 03 and 04

This field specifies the element address of the next cartridge the library should process. This field must be 0 if either NxtVal or S/R are 0.

Parity Page (00h)

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (00h)					
01	Parameter List Length							
02	Reserved		Parity	Reserved				
03	Reserved							

Parameter List Length - Byte 01

This field indicates the length of the parity parameter list. The Parameter List Length is 02h, which indicates that there are two additional bytes of parameter data that follow this byte.

Parity - Byte 02, Bit 5

This field enables or disables SCSI bus parity checking. The valid values for this field are as follows:

0 – Disable bus parity checking
1 – Enable bus parity checking

This feature is factory set in nonvolatile RAM. The factory default is 1.

> **Note:** The Parity bit works in conjunction with the LCD parity option, as described on page 2-2.

7.3   How the Library Executes This Command

This section describes how the library executes the MODE SELECT command. The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed (see Chapter 3).

Figure 7-2 shows the steps that the library takes when executing the command through the bus free phase. As shown in the figure, the library validates the parameters in both the CDB and MODE SELECT data. Table 7-2 shows the sense data reported for invalid parameters in the CDB and in the MODE SELECT data.

> **Note:** This section describes the normal processing of the command through the bus free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a message out phase or if parity errors are detected on the MODE SELECT data.
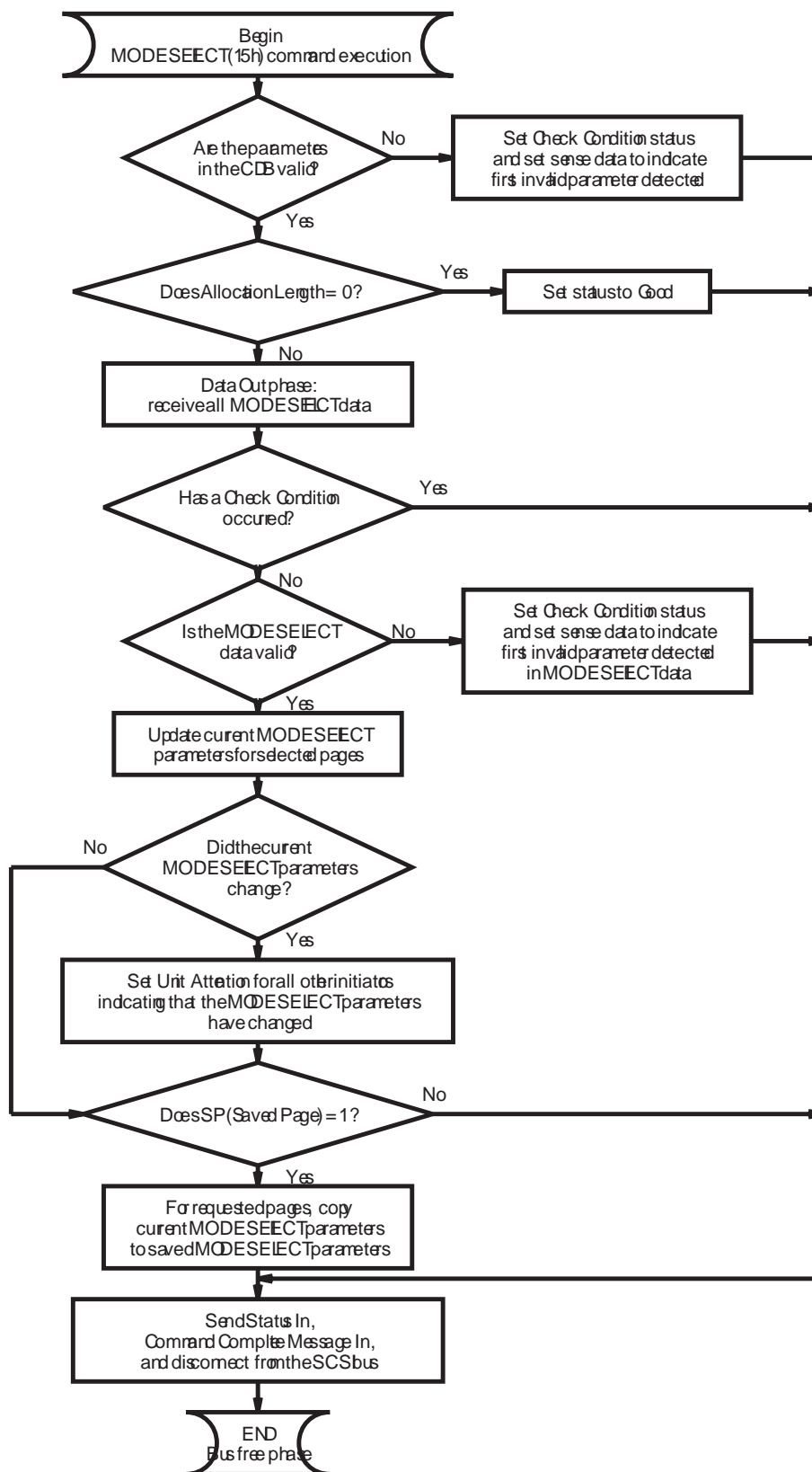
Figure 7-2 MODE SELECT command execution

7.4   Command Status

The library returns a status byte after processing the MODE SELECT command.

Good

The library returns Good status when it is able to process the command without errors (that is, when the requested MODE SELECT parameters have been copied over the current MODE SELECT settings and, if requested, the saved MODE SELECT settings).

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status for the following reasons:

- The library is reserved by a different initiator.

- A library element is reserved by a different initiator and the Element Address Assignment page would change that element's address.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.

- The library detects an unrecoverable parity error while receiving the CDB.

- The command is issued to an invalid LUN.

- A Unit Attention condition is pending for the initiator.

- A reserved bit is set to 1 in the CDB.

- A parameter in the CDB is invalid (see Table 7-2 for sense data).

■ The library detects an unrecoverable parity error while receiving the MODE SELECT data.

■ A parameter in the MODE SELECT data is invalid (see Table 7-2 for sense data).

Table 7-2 Invalid parameters in the MODE SELECT CDB and mode data

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	1Ah	00	1	1	0	0	0004h	Invalid Parameter List Length.
5h	24h	00	1	1	1	4h	0001h	Invalid PF (page format).
5h	26h	00	1	0	0	0	*	Invalid values in the Parameter List Header. All values must be 0. The value of the field pointer is the value of the first field that contains a non-zero value (00, 01, 02, or 03)
5h	26h	00	1	0	0	0	*	Reserved bits set in the reserved fields 22 or 23 (bytes 18 or 19 of the Element Address Assignment page).
5h	26h	00	1	0	1	5h	*	Invalid Page Code.
5h	26h	00	1	0	1	7h	*	Reserved bits set in the Element Address Assignment page Page Code field.
5h	26h	00	1	0	1	7h	*	Reserved bits set in the LCD Mode page.
5h	26h	02h	1	0	0	0	*	Address overlap. The field pointer is set to the value representing the field in the Element Address Parameter List which caused the address overlap, as follows: 0006h Medium Transport Element 　　　　 Address 000Ah Storage Element Address
5h	26h	02h	1	0	0	0	*	Invalid number of transport elements.
5h	26h	02h	1	0	0	0	*	Invalid number of medium storage elements.
5h	26h	02h	1	0	0	0	*	Invalid number of import/export elements.
5h	26h	02h	1	0	0	0	*	Invalid number of data transfer elements.

* The Field Pointer value depends on the order in which the pages are sent.

8 MODE SENSE (1Ah)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	0	1	0
01	Logical Unit Number			RSVD	DBD	Reserved		
02	PC		Page Code					
03	Reserved							
04	Allocation Length							
05	0	0	Reserved				0	0

8.1 About This Command

The MODE SENSE command enables the library to report its operating mode parameters to the initiator. The initiator can request one or all pages of mode parameters. Each transfer of data includes four bytes for the Parameter List Header, followed by the specified number of bytes for each page:

- 20 bytes for the Element Address Assignment page
- 4 bytes for the Transport Geometry Descriptor page
- 20 bytes for the Device Capabilities page
- 4 bytes for the Baud Rate page
- 84 bytes for the LCD Mode page
- 6 bytes for the Sequential Option page
- 4 bytes for the Parity page

Using the MODE SELECT (15h) command, you can change the values of all of these parameters except the Transport Geometry Descriptor page and the Device Capabilities page.

8.2 What You Send to the Library

DBD (Disable Block Descriptors) - Byte 01, Bit 3

The library does not use block descriptors. The value for this field must be 1.

PC (Page Control) - Byte 02, Bits 7 and 6

This field defines the type of parameters that are to be returned for the MODE SENSE command. Specify one of the following values:

0 – Current values   Indicates that the library returns the current parameter values. The current values returned are:

- The parameters set in the last successful MODE SELECT command.

- The saved values, if a MODE SELECT command has not been executed since the last power-on, SCSI bus reset, or Bus Device Reset message.

- The default values, if saved values are not available.

1 – Changeable values   Indicates that the library should return the changeable parameter masks. The pages you request are returned and indicate which parameters you can change. All bits of parameters that you can change are set to 1. All bits of parameters that you cannot change are set to 0. The Page Code fields and the Parameter List Length fields contain actual values.

Note: Before issuing a MODE SELECT command, issue a MODE SENSE command with the PC field set to 1 and the Page Code field set to 3Fh. This will allow you to determine the supported pages, the changeable parameters within the pages, and the supported length of each page. Note that if the library is in EXB-10i emulation mode (the Emu10i bit on the Sequential Option page is set to 1), it returns only those pages supported by the EXB-10i.

2 – Default values   Indicates that the library should return the default values. The pages you request are returned, with each supported parameter set to its default value. Parameters not supported by the library are set to 0.

3 – Saved values   Indicates that the library should return the saved values. The pages you request are returned, with each supported parameter set to its saved value. Parameters not supported by the library are set to 0.

Note: For a PC value of 3, if no page has been saved, the library returns default values.

Page Code - Byte 02, Bits 5 through 0

This field allows you to specify which page the library should return. Specify one of the following values:

1Dh – Element Address Assignment page
1Eh – Transport Geometry Descriptor page
1Fh – Device Capabilities page
20h – Baud Rate page
22h – LCD Mode page
23h – Sequential Option page
00h – Parity page
3Fh – All pages (in the above order)

Note: If the library is in EXB-10i emulation mode (the Emu10i bit on the Sequential Option page is set to 1) and you specify a Page Code of 3Fh (all pages), the library returns only those pages supported by the EXB-10i. (The LCD Mode page and Sequential Option page are not returned.) While the library is in EXB-10i emulation mode, you can retrieve these pages by issuing separate MODE SENSE commands with the Page Code set to 22h (for the LCD Mode page) and 23h (for the Sequential Option page).

Allocation Length - Byte 04

This field allows you to specify the length of the parameter list the library will return. The maximum length you need to specify to receive all pages is 146 (92h) bytes.

The library terminates the data in phase when the number of bytes specified by the Allocation Length have been transferred or when all available MODE SENSE data have been transferred to the initiator, whichever is less.

8.3   What the Library Returns

Parameter List Header

Bit Byte	7	6	5	4	3	2	1	0
00	Sense Data Length							
01	Reserved							
02								
03								

Sense Data Length - Byte 00

This field indicates the number of bytes of parameter information the library is returning as a result of this command, excluding the Sense Data Length byte and including the three additional Parameter List Header bytes.

Element Address Assignment Page (1Dh)

Bit Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (1Dh)					
01	Parameter List Length							
02	(MSB)	Medium Transport Element Address						
03								(LSB)
04	(MSB)	Number of Medium Transport Elements						
05								(LSB)
06	(MSB)	First Storage Element Address						
07								(LSB)
08	(MSB)	Number of Storage Elements						
09								(LSB)
10	(MSB)	First Import/Export Element Address						
11								(LSB)
12	(MSB)	Number of Import/Export Elements						
13								(LSB)
14	(MSB)	First Data Transfer Element Address						
15								(LSB)
16	(MSB)	Number of Data Transfer Elements						
17								(LSB)
18	Reserved							
19	Reserved							

For the element-specific field definitions in the following list, refer to Figure 7-1 in Chapter 7.

PS (Page Savable) - Byte 00, Bit 7

The value returned for this field is 1, which indicates that the library is capable of saving this page to nonvolatile memory.

Parameter List Length - Byte 01

The value returned for this field is 18 (12h), which indicates that there are an additional 18 bytes of element address data that follow this byte.

Medium Transport Element Address - Bytes 02 and 03

This field identifies the address of the cartridge handling mechanism (CHM). The default address is 0Bh (11). You can change this address with the MODE SELECT (15h) command.

Number of Medium Transport Elements - Bytes 04 and 05

This field identifies the number of CHMs within the library. The library has only one CHM, so the value returned for this field is 1. This value cannot be changed.

First Storage Element Address - Bytes 06 and 07

This field identifies the starting address of the data cartridge storage locations. The default starting address is 01. You can change this address with the MODE SELECT (15h) command.

Number of Storage Elements - Bytes 08 and 09

This field identifies the number of data cartridge storage locations within the library. The total number of data cartridge storage locations is 10, so the value returned for this field is 0Ah (10). This value cannot be changed.

First Import/Export Element Address - Bytes 10 and 11

Since the library does not have an import/export element, the value returned for this field is 0.

Number of Import/Export Elements - Bytes 12 and 13

Since the library does not have an import/export element, the value returned for this field is 0. This value cannot be changed.

First Data Transfer Element Address - Bytes 14 and 15

The library has only one tape drive. The default value returned for this field is 0. You can change this address with the MODE SELECT (15h) command.

Number of Data Transfer Elements - Bytes 16 and 17

Since the library has only one tape drive, the value returned for this field is 1. This value cannot be changed.

Transport Geometry Descriptor Page (1Eh)

Bit Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (1Eh)					
01	Parameter Length							
02	Reserved							Rotate
03	Member Number in Transport Element Set							

PS (Page Savable) - Byte 00, Bit 7

The value returned for this field is 0, which indicates that the library cannot save this page to nonvolatile memory.

Parameter Length - Byte 01

This field indicates the number of additional bytes of transport geometry descriptor data that follow the header. Each descriptor consists of two bytes of information. The library has only one transport mechanism (CHM), so the value returned for this field is 02h.

Rotate - Byte 02, Bit 0

This field identifies the ability of the transport mechanism to handle two-sided media. The library uses only one-sided media, so the value returned for this field is 0.

Member Number in Transport Element Set - Byte 03

This field identifies the specific transport element in the system to apply this descriptor to. The library has only one transport element, so the value returned for this field is 0.

Device Capabilities Page (1Fh)

Bit Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (1Fh)					
01	Parameter Length (12h)							
02	Reserved				DT 1	I/E 0	ST 1	MT 0
03	Reserved							
04	Reserved				MT→DT 1	MT→I/E 0	MT→ST 1	MT→MT 0
05	Reserved				ST→DT 1	ST→I/E 0	ST→ST 1	ST→MT 1
06	Reserved				I/E→DT 0	I/E→I/E 0	I/E→ST 0	I/E→MT 0
07	Reserved				DT→DT 1	DT→I/E 0	DT→ST 1	DT→MT 1
08 ⋮ 19	Reserved							

DT – Tape drive

I/E – Import/export element (the library does not have an import/export element)

MT – Cartridge handling mechanism (CHM)

ST – Storage location (slot in data cartridge magazine)

0 – move not supported

1 – move supported

PS (Page Savable) - Byte 00, Bit 7

The value returned for this field is 0, which indicates that the library cannot save this page to nonvolatile memory.

Parameter Length - Byte 01

The Parameter Length is 12h (18) which indicates that there are an additional 18 bytes of device capabilities data that follow this byte.

DT - Byte 02, Bit 3

The value returned for this field is 1, which indicates that the tape drive can store a data cartridge.

I/E - Byte 02, Bit 2

The library does not have an import/export element, so the value returned for this field is 0.

ST - Byte 02, Bit 1

The value returned for this field is 1, which indicates that the data cartridge storage locations can store data cartridges.

MT - Byte 02, Bit 0

The value returned for this field is 0, which indicates that the CHM cannot store data cartridges.

MT → DT - Byte 04, Bit 3

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is the CHM and the destination is a tape drive.

MT → I/E - Byte 04, Bit 2

The value returned for this field is 0, which indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is the CHM and the destination is the import/export element (the library does not have an import/export element).

MT → ST - Byte 04, Bit 1

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is the CHM and the destination is a data cartridge storage location.

MT → MT - Byte 04, Bit 0

The value returned for this field is 0, which indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is the CHM and the destination is the CHM.

ST → DT - Byte 05, Bit 3

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a data cartridge storage location and the destination is a tape drive.

ST → I/E - Byte 05, Bit 2

The value returned for this field is 0, which indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is a data cartridge storage location and the destination is the import/export element (the library does not have an import/export element).

ST → ST - Byte 05, Bit 1

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a data cartridge storage location and the destination is a data cartridge storage location.

ST → MT - Byte 05, Bit 0

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a data cartridge storage location and the destination is the CHM.

I/E → DT - Byte 06, Bit 3

The value returned for this field is 0, which indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is the import/export element and the destination is a tape drive (the library does not have an import/export element).

I/E → I/E - Byte 06, Bit 2

The value returned for this field is 0, which indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is the import/export element and the destination is the import/export element (the library does not have an import/export element).

I/E → ST - Byte 06, Bit 1

The value returned for this field is 0, which indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is the import/export element and the destination is a data cartridge storage location (the library does not have an import/export element).

I/E → MT - Byte 06, Bit 0

The value returned for this field is 0, which indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is the import/export element and the destination is the CHM (the library does not have an import/export element).

DT → DT - Byte 07, Bit 3

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is a tape drive.

DT → I/E - Byte 07, Bit 2

The value returned for this field is 0, which indicates that the library does not support the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is the import/export element (the library does not have an import/export element).

DT → ST - Byte 07, Bit 1

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is a data cartridge storage location.

DT → MT - Byte 07, Bit 0

The value returned for this field is 1, which indicates that the library supports the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is the CHM.

Baud Rate Page (20h)

Bit Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (20h)					
01	Parameter List Length							
02	(MSB)	Baud Rate						
03								(LSB)

PS (Page Savable) - Byte 00, Bit 7

This field specifies that the library is capable of saving this page to nonvolatile memory. The value returned for this field is 1.

Parameter List Length - Byte 01

The value for this field is 02h, which indicates that there are two additional bytes of baud rate data that follow this byte.

Baud Rate - Bytes 02 and 03

This field specifies the values of the baud rate. The default is 9600.

LCD Mode Page (22h)

Bit Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (22h)					
01	Parameter List Length							
02	Reserved				Write Line 1	Write Line 2	Write Line 3	Write Line 4
03	Reserved							
04 ⋮ 23	Display Line 1							
24 ⋮ 43	Display Line 2							
44 ⋮ 63	Display Line 3							
64 ⋮ 83	Display Line 4							

PS - Byte 00, Bit 07 (Page Savable)

This field specifies that the library is capable of saving this page to nonvolatile memory. The value returned for this field is 1.

Parameter List Length - Byte 01

This field indicates the length of the LCD Mode page. The value returned for this field is 82 (52h).

Write Line 1 - Byte 02, Bit 3

This field indicates the text used for Line 1 of the display, as follows:

0 – Library's internal text, for example "Exabyte EXB-10h" or "Exabyte EXB-10e"

1 – Text you specified in bytes 4 through 23 of the LCD Mode page from the last MODE SELECT command

Write Line 2 - Byte 02, Bit 2

This field indicates the text used for Line 2 of the display, as follows:

0 – Library's internal text, for example "VER *x.yy.zz hh:mm:ss*"

1 – Text you specified in bytes 24 through 43 of the LCD Mode page
from the last MODE SELECT command

Write Line 3 - Byte 02, Bit 1

This field indicates the text used for Line 3 of the display, as follows:

0 – Library's internal text, for example a high-level status message

1 – Text you specified in bytes 44 through 63 of the LCD Mode page
from the last MODE SELECT command

Write Line 4 - Byte 02, Bit 0

This field indicates the text used for Line 4 of the display, as follows:

0 – Library's internal text, for example a low-level status message

1 – Text you specified in bytes 64 through 83 of the LCD Mode page
from the last MODE SELECT command

Display Line 1 - Bytes 04 through 23

This field specifies the text that the library displays on Line 1 of the
LCD when the Write Line 1 field is set to 1.

> **Note:** Refer to Appendix C for the LCD character set for the
> Display Line fields.

Display Line 2 - Bytes 24 through 43

This field specifies the text that the library displays on Line 2 of the
LCD when the Write Line 2 field is set to 1.

Display Line 3 - Bytes 44 through 63

This field specifies the text that the library displays on Line 3 of the
LCD when the Write Line 3 field is set to 1.

Display Line 4 - Bytes 64 through 83

This field specifies the text that the library displays on Line 4 of the
LCD when the Write Line 4 field is set to 1.

Sequential Option Page (23h)

Bit / Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (23h)					
01	Parameter List Length							
02	Emu10i	Reserved			S/R	Loop	Restrt	NxtVal
03	(MSB)	Next Cartridge Element Address						
04								(LSB)
05	Reserved							

PS (Page Savable) - Byte 00, Bit 7

This field specifies that the library is capable of saving this page to nonvolatile memory. The value returned for this field is 1.

Parameter List Length - Byte 01

The value for this field is 04h, which indicates that there are four additional bytes of data that follow this byte.

Emu10i - Byte 02, Bit 7

This field indicates whether the library emulates the EXB-10i when it receives INQUIRY, MODE SENSE, or LOG SENSE commands:

0 – Does not emulate the EXB-10i
1 – Emulates the EXB-10i

Table 8-1 shows the library's response to the INQUIRY, MODE SENSE, and LOG SENSE commands when this field is set to 1 (emulate EXB-10i).

Table 8-1 Library actions when the Emu10i bit is set to 1

Command received by library	Parameters	Library's response
INQUIRY	–	Returns "EXB-10i" instead of "EXB-10e" for the Product Identification.
LOG SENSE	Log Parameter Code 117 (without 118)	Returns the sum of the Inner Slot Pick Retries and the Outer Slot Pick Retries since the EXB-10i has just one slot pick retry count.
	Log Parameter Codes 117 and 118	Returns only log parameter 117 as described above.
	Log Parameter Code 118 (without 117)	Returns only the Outer Slot Pick Retries. (This value can be used with log parameter 117 to obtain the Inner Slot Pick Retries.)
MODE SENSE	Page Code = 3Fh (all pages)	Returns only those pages supported by the EXB-10i. (The LCD Mode page and the Sequential Option page are not returned.) **Note**: You can request these pages using the MODE SENSE command with the Page Code set to 22h (for the LCD Mode page) or 23h (for the Sequential Option page). You can modify these pages using the MODE SELECT command.

S/R - Byte 02, Bit 3

This field indicates which mode the library is operating in:

0 – Random mode
1 – Sequential mode

Loop - Byte 02, Bit 2

When S/R is 1 (sequential mode), this field indicates whether the library stops processing cartridges after cartridge 10, or whether it loops back to cartridge 1 and continues processing:

0 – Stops after cartridge 10 has been processed
1 – Loops through cartridges continuously

If S/R is 0 (random mode), this field must be 0.

Restrt - Byte 02, Bit 1

When S/R is 1 (sequential mode), this field indicates whether the library resumes processing with cartridge 1 after a reset or power cycle, or whether it resumes processing at the point it left off:

0 – Resumes processing where interrupted
1 – Resumes processing with cartridge 1

If S/R is 0 (random mode), this field must be 0.

NxtVal - Byte 02, Bit 0

This field indicates whether the Next Cartridge Element Address field (bytes 03 and 04) is valid:

0 – Ignore the Next Cartridge Element Address field
1 – Next Cartridge Element Address field is valid

Next Cartridge Element Address - Bytes 03 and 04

This field specifies the element address of the next cartridge the library will process. This field must be 0 if either NxtVal or S/R are 0.

Parity Page (00h)

Bit Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (00h)					
01	Parameter List Length							
02	Reserved		Parity	Reserved				
03	Reserved							

PS (Page Savable) - Byte 00, Bit 7

This field specifies that the library is capable of saving this page to nonvolatile memory. The value returned for this field is 1.

Parameter List Length - Byte 01

The value for this field is 02h, which indicates that there are two additional bytes of parity data that follow this byte.

Parity - Byte 02, Bit 5

This field indicates whether SCSI bus parity is enabled or disabled with the MODE SELECT (15h) parameters, as follows:

0 – SCSI bus parity checking disabled
1 – SCSI bus parity checking enabled

The factory default is 1.

> **Note:** The Parity bit works in conjunction with the LCD parity option, as described on page 2-2.

8.4   How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 8-1 shows the steps that the library takes when executing the command through the bus free phase. As shown in the figure, the library validates the parameters in the CDB.

Table 8-2 shows the sense data reported for invalid parameters in the CDB.

> **Note:** The section describes the normal processing of the command through the bus free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a message out phase.
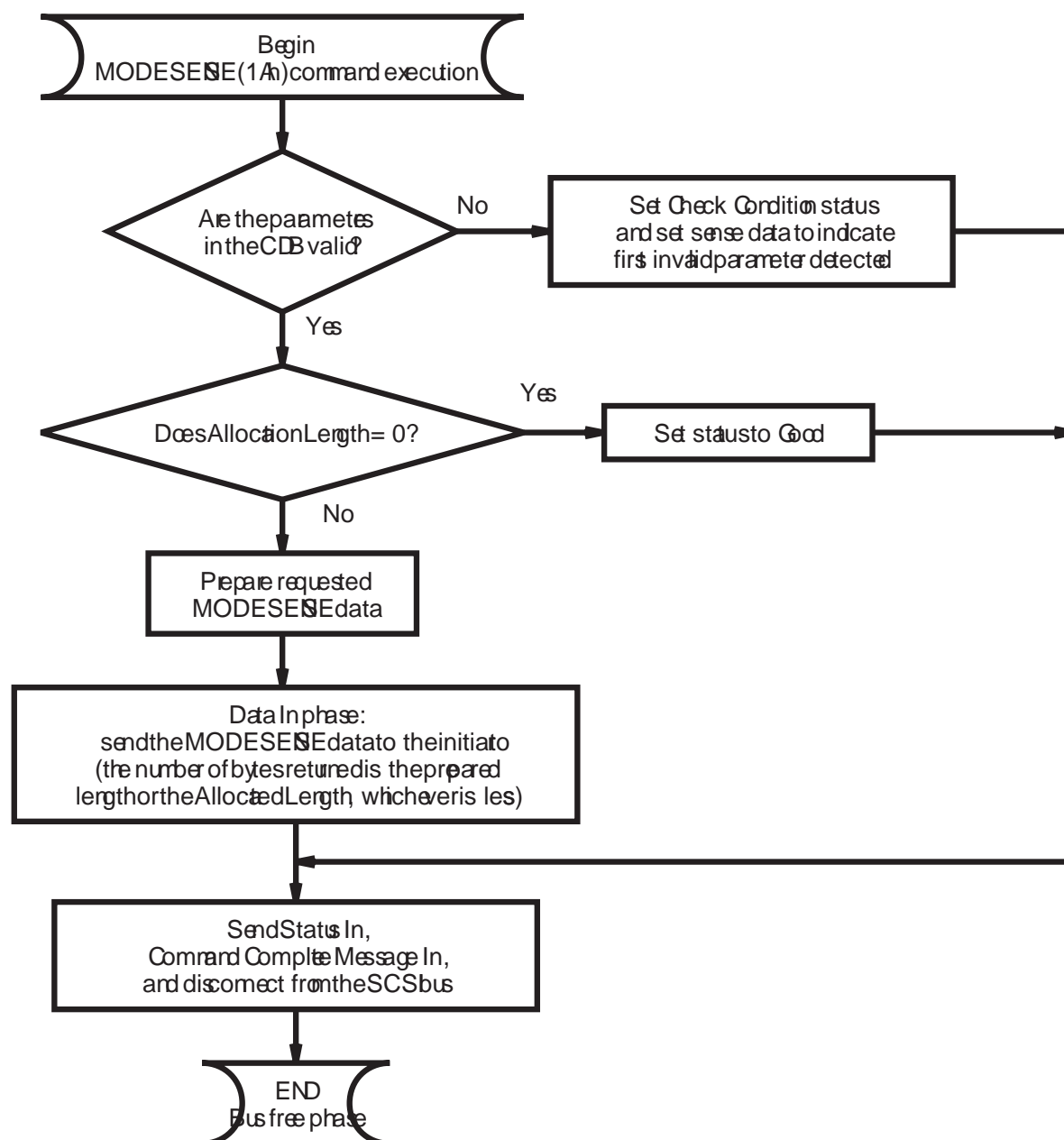
Figure 8-1 MODE SENSE command execution

8.5   Command Status

The library returns a status byte after processing the MODE SENSE command.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 15 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

■ The message system is enabled and a message error occurs while the library is processing the command.

■ The library detects an unrecoverable parity error while receiving the CDB.

■ The command is issued to an invalid LUN.

■ A Unit Attention condition is pending for the initiator.

■ A reserved bit is set to 1 in the CDB.

■ A parameter in the CDB is invalid (see Table 8-2 for sense data).

Table 8-2 Invalid parameters in the MODE SENSE CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00	1	1	1	3h	0001h	Invalid value in DBD field.
5h	24h	00	1	1	1	5h	0002h	Invalid Page Code.

9 MOVE MEDIUM (A5h)

Bit Byte	7	6	5	4	3	2	1	0
00	1	0	1	0	0	1	0	1
01	Logical Unit Number			Reserved				
02	(MSB)			Transport Element Address				
03								(LSB)
04	(MSB)			Source Address				
05								(LSB)
06	(MSB)			Destination Address				
07								(LSB)
08	Reserved							
09								
10	Reserved							Invert
11	0	0	Reserved				0	0

9.1   About This Command

The MOVE MEDIUM command requests that the library move a data cartridge from a source element location (source address) to a destination element location (destination address). If the destination is the tape drive, the library will insert the cartridge. (For the EXB-10e, the library also closes the tape drive door.)

For the valid source element and destination element combinations for the MOVE MEDIUM command, refer to the Device Capabilities page of the MODE SENSE data (see page 8-8).

9.2   What You Send to the Library

Transport Element Address - Bytes 02 and 03

This field is checked for the value set by the MODE SELECT command or the default address for the CHM (0Bh) if a MODE SELECT command was not issued. Specify either the element address of the CHM or 00h.

Source Address - Bytes 04 and 05

This field allows you to specify the element location (address) where the data cartridge is to be taken from. This can be a storage location, the tape drive, or the CHM.

Destination Address - Byte 06 and 07

This field allows you to specify the element location (address) where the data cartridge is to be placed. This can be a storage location, the tape drive, or the CHM.

Invert - Byte 10, Bit 0

Since the library does not support the Invert function, you must specify a value of 0 for this field.

9.3   Effects on the Cartridge Inventory

The library updates the cartridge inventory after each cartridge move operation, whether or not the move was successful. The following list describes how the cartridge inventory is affected depending on the state of the data cartridge magazine and tape drive when you issue a MOVE MEDIUM command. For more information about the cartridge inventory, see page 2-6.

■   If you issue a MOVE MEDIUM command that is completed successfully (that is, when the source address contained a cartridge, the destination address was empty, and the cartridge was moved), the library updates the cartridge inventory for the source and destination addresses as shown in Table 9-1.

Table 9-1 Effect on the cartridge inventory of a successful move operation

This cartridge inventory field...	...is changed to the following for...	
	...the source address	...the destination address
Occupied	0	1
Occupied Valid	1	1
Source Address	255	*source element index*
Source Valid	0	1

■ If you issue a MOVE MEDIUM command when the source address is empty (the Occupied flag is set to 0 and the Occupied Valid flag is set to 1 in the cartridge inventory), the library does not attempt to move the cartridge and updates the cartridge inventory as shown in Table 9-2.

Table 9-2 Effect on the cartridge inventory of a move operation when the source is empty

This cartridge inventory field...	...is changed to the following for...	
	...the source address	...the destination address
Occupied	0	no change
Occupied Valid	1	no change
Source Address	255	no change
Source Valid	0	no change

■ If you issue a MOVE MEDIUM command when the destination address is full (the Occupied flag is set to 1 and the Occupied Valid flag is set to 1 in the cartridge inventory), the library does not attempt to move the cartridge and updates the cartridge inventory as shown in Table 9-3.

Table 9-3 Effect on the cartridge inventory of a move operation when the destination is full

This cartridge inventory field...	...is changed to the following for...	
	...the source address	...the destination address
Occupied	1	1
Occupied Valid	1	1
Source Address	no change	no change
Source Valid	no change	no change

■ If you issue a MOVE MEDIUM command specifying the same source and destination address, the library does not attempt to move the cartridge if the Occupied Valid flag (in the cartridge inventory) is set to 1 for the source or destination address and the location is a storage location. The library updates the cartridge inventory as shown in Table 9-4.

Note: You can request this type of operation when the occupied status of a location is questionable (the Occupied Valid flag in the cartridge inventory is set to 0).

Table 9-4 Effect on the cartridge inventory of a move operation when the source and destination are the same

This cartridge inventory field...	...is changed to the following when...	
	...the location is empty	...the location is full
Occupied	0	1
Occupied Valid	1	1
Source Address	255	*element index*
Source Valid	0	1

9.4   How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

The library does the following when it receives a MOVE MEDIUM command:

1. Validates the source and destination for the move, as shown in Figure 9-1 and Figure 9-2.

2. Executes the move operation, as shown in Figure 9-3.

As shown in Figure 9-3, the library validates the parameters in the CDB. Table 9-5 shows the sense data reported for invalid parameters in the CDB and also shows the sense data for various move errors.

Note: This section describes the normal processing of the command through the bus free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a message out phase.

Figure 9-1 MOVE MEDIUM command—source validation

Figure 9-2 MOVE MEDIUM command—destination validation
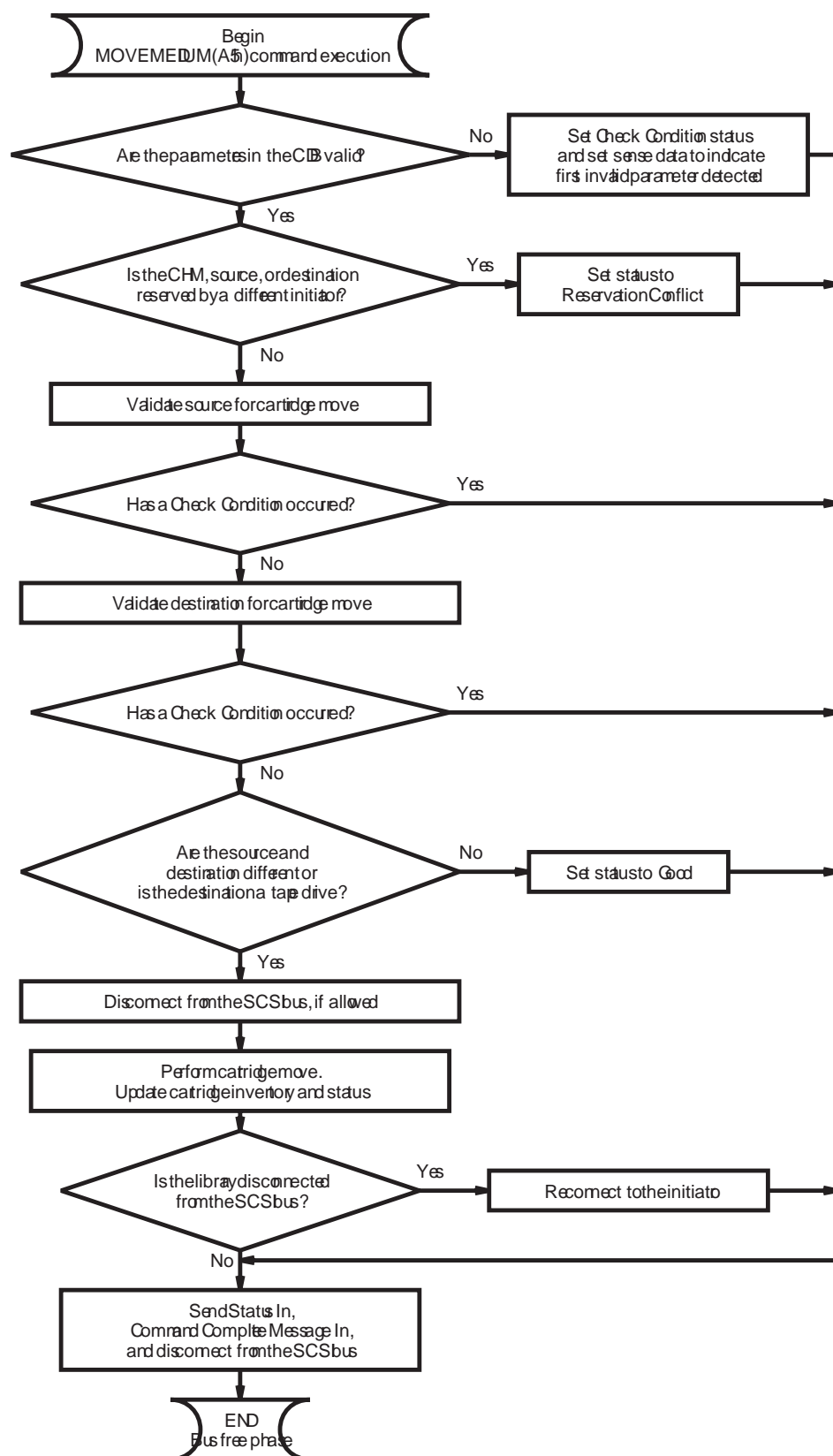
Figure 9-3 MOVE MEDIUM command—cartridge move

9.5   Command Status

The library returns a status byte after processing the MOVE MEDIUM command.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator or when an element involved in a requested move operation is reserved by a different initiator. See Chapter 15 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.

- The library detects an unrecoverable parity error while receiving the CDB.

- The command is issued to an invalid LUN.

- A Unit Attention condition is pending for the initiator.

- The library has experienced an unrecoverable hardware error.

- The library door is open or was opened during the move.

- The data cartridge magazine is missing.

- A reserved bit is set to 1 in the CDB.

- A parameter in the CDB is invalid (see Table 9-5 for sense data).

- The library is not ready because the door is open, or it is operating in sequential mode, LCD mode, or CHS Monitor mode.

- The information in the cartridge inventory indicates that the requested cartridge move operation cannot be performed. Refer to Table 9-5 for a complete list of errors.

- After the library attempts to move a cartridge, it finds that the source is empty or the destination is occupied.

- The library encounters a problem while trying to move a cartridge. For example, a place (put) error is encountered while moving a cartridge.

Table 9-5 Invalid parameters in the MOVE MEDIUM CDB and move errors

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
4h	3Bh	87h	0	0	0	0	0000h	Could not seat the cartridge in the grab base. Returned source cartridge to original slot.
5h	24h	00	1	1	1	0	000Ah	Invalid Invert field.
5h	24h	80h	1	1	0	0	0002h	Invalid transport element address.
5h	24h	80h	1	1	0	0	0004h	Invalid source element address.
5h	24h	80h	1	1	0	0	0006h	Invalid destination element address.
5h	3Bh	80h	0	0	0	0	0000h	The grab base contained a cartridge before the move.
5h	3Bh	0Dh	0	0	0	0	0000h	Destination element occupied.
5h	3Bh	0Eh	0	0	0	0	0000h	Source element empty.
5h	3Bh	83h	0	0	0	0	0000h	EXB-10h: The source tape drive contains no cartridge, or the cartridge has not been ejected from the tape drive. EXB-10e: The source tape drive's door is closed.
5h	3Bh	84h	0	0	0	0	0000h	EXB-10h: The destination tape drive already contains a cartridge. EXB-10e: The destination tape drive's door is closed.

10 POSITION TO ELEMENT (2Bh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	1	0	1	0	1	1
01	Logical Unit Number			Reserved				
02	(MSB)							
03				Transport Element Address				(LSB)
04	(MSB)							
05				Destination Element Address				(LSB)
06	Reserved							
07								
08	Reserved							Invert
09	0	0	Reserved				0	0

10.1 About This Command

The POSITION TO ELEMENT command allows you to request that the cartridge handling mechanism (CHM) be positioned to a specific element location (address).

The CHM is positioned so that no additional vertical movement is required to access the cartridge at that location for a MOVE MEDIUM (A5h) command. Use this command with an application that may require a pause before issuing a MOVE MEDIUM command. The time that you save with the POSITION ELEMENT command is valuable if you would normally have to wait for the CHM to move to the element when you issue the MOVE MEDIUM command.

10.2 What You Send to the Library

Transport Element Address - Bytes 02 and 03

Because this field is checked for the value set by the MODE SELECT (15h) command (or the default if the MODE SELECT command was not issued), you should specify the element address of the CHM. The library also allows a value of 00h in place of the MODE SELECT value or default value (0Bh).

Destination Element Address - Bytes 04 and 05

This field allows you to specify the address of the element where the CHM is to be positioned. If the destination address is the CHM, the library positions the grab base in the park position (at the bottom of the library). Use the CHM as the destination address if you want to move the CHM out of the way so you can easily access the tape drive or data cartridge magazine.

Invert - Byte 08, Bit 0

The library does not support the Invert function, so you must specify a value of 0 for this field.

10.3 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 10-1 shows the steps that the library takes when executing the POSITION TO ELEMENT command through the bus free phase. As shown in the figure, the library validates the parameters in the CDB. Table 10-1 shows the sense data reported for invalid parameters in the CDB. It also shows the sense data for various position errors.

> **Note:** This section describes the normal processing of the command through the bus free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a message out phase.
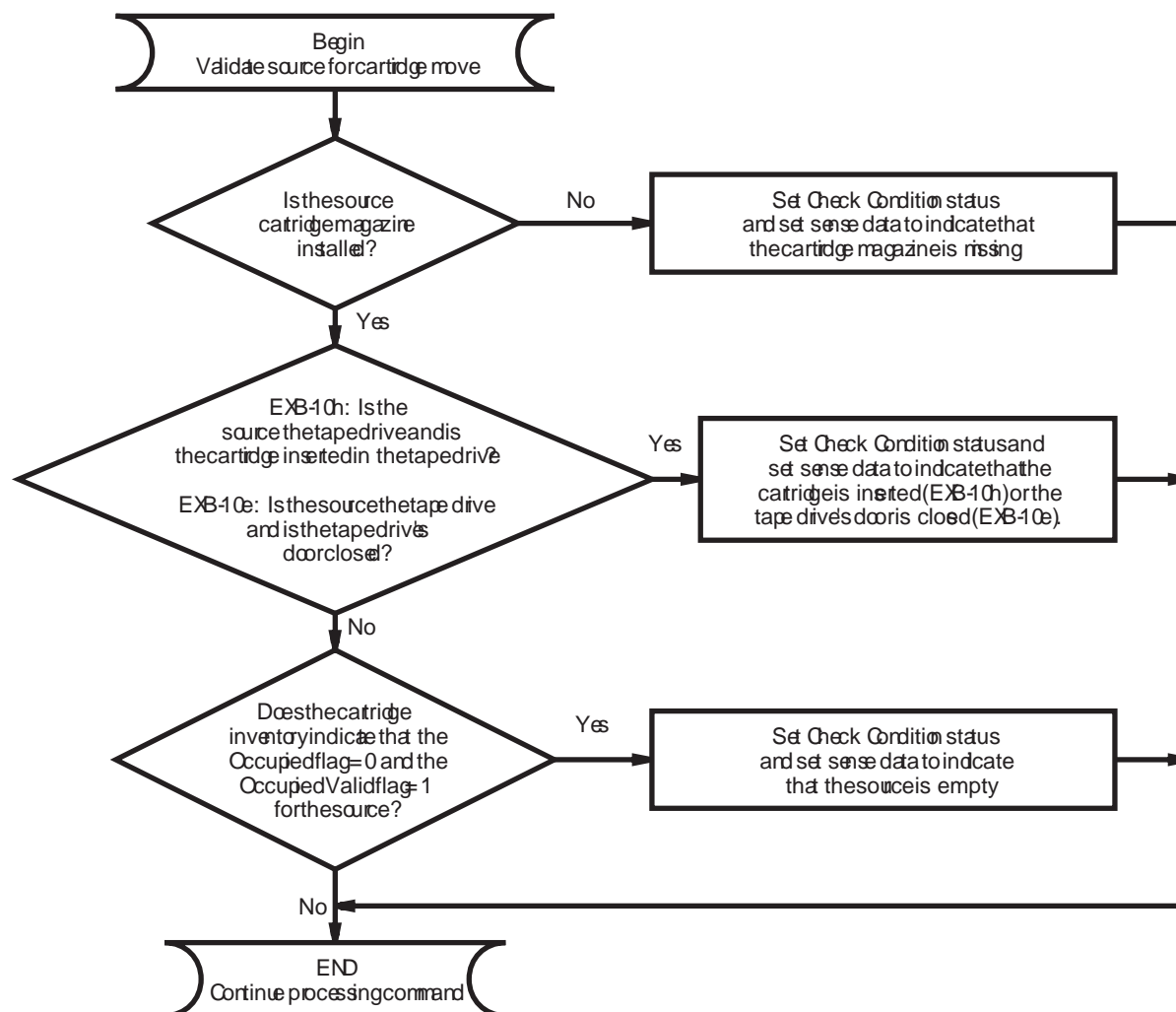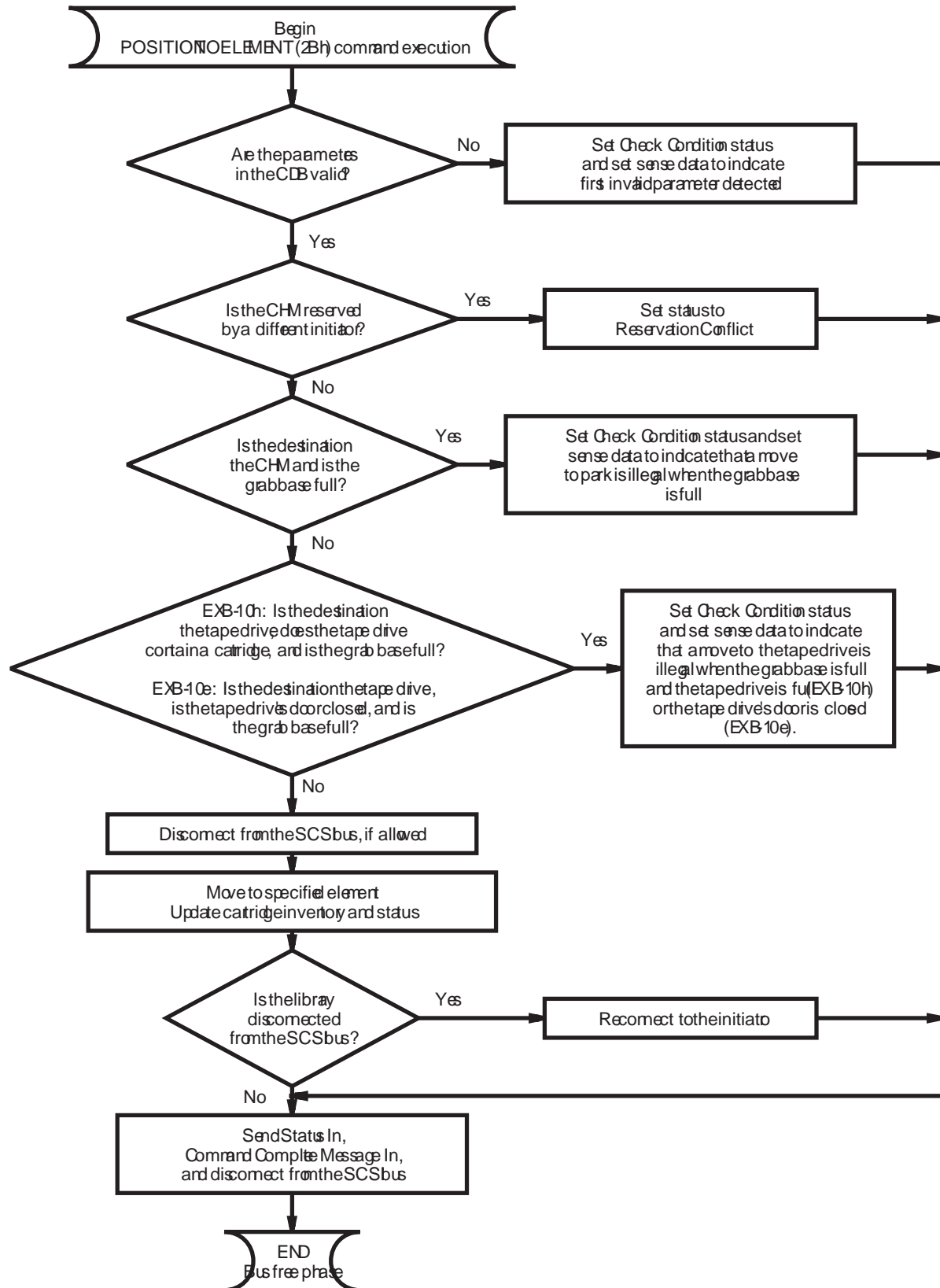
Figure 10-1 POSITION TO ELEMENT command execution
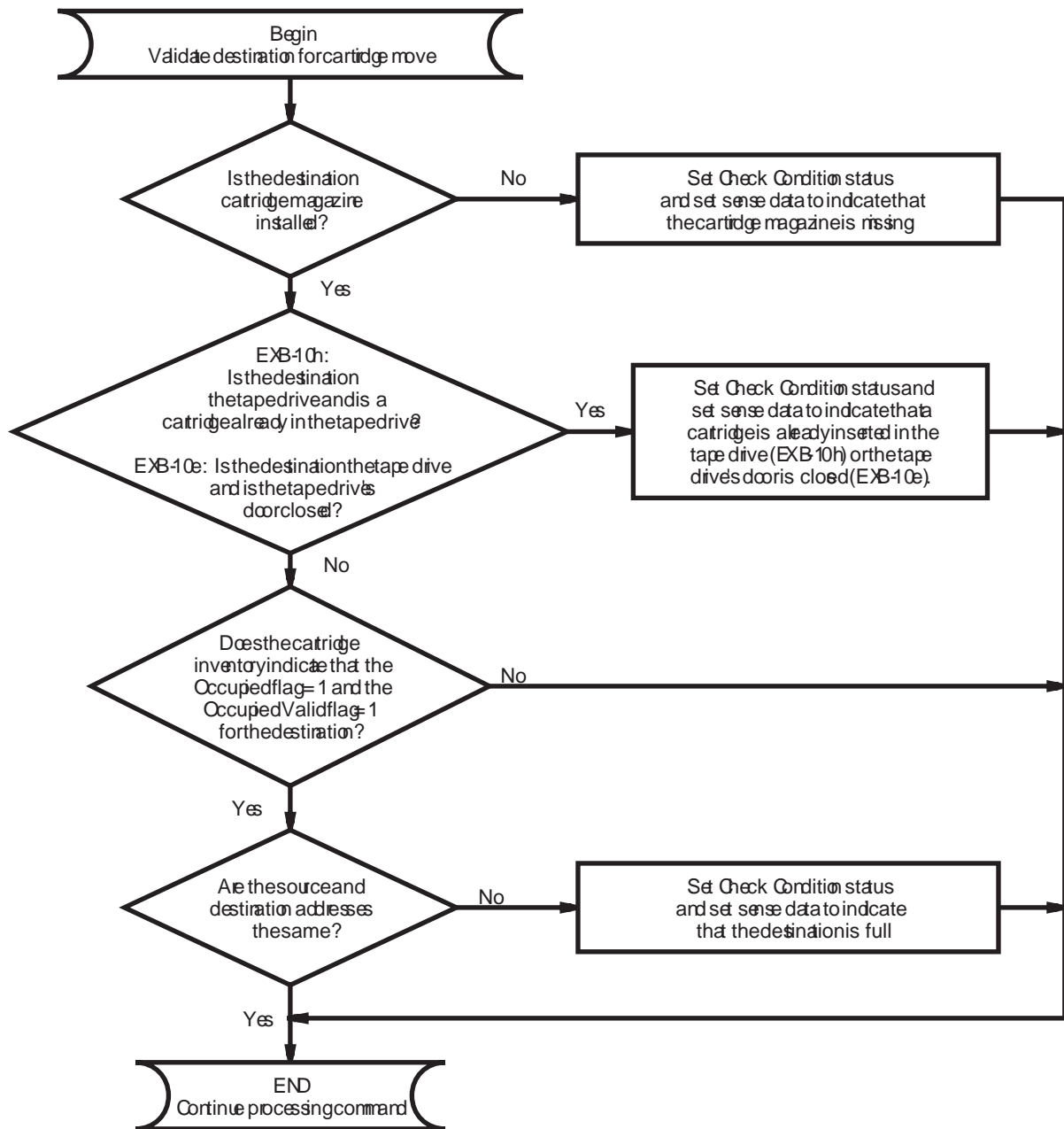
10.4 Command Status

The library returns a status byte after processing the POSITION TO ELEMENT command.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 15 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.

- The library detects an unrecoverable parity error while receiving the CDB.

- The command is issued to an invalid LUN.

- A Unit Attention condition is pending for the initiator.

- The library has experienced an unrecoverable hardware error.

■ The library is not ready because the door is open, or it is operating in sequential mode, LCD mode, or CHS Monitor mode.

■ A reserved bit is set to 1 in the CDB.

■ A parameter in the CDB is invalid (see Table 10-1 for sense data).

■ The library encounters a problem during the position operation.

■ The library door is open or was opened during the move.

■ The data cartridge magazine is missing.

Table 10-1 Invalid parameters in POSITION TO ELEMENT CDB and position errors

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00	1	1	1	0	0008h	Invalid Invert field.
5h	24h	80h	1	1	0	—	0002h	Invalid transport element address.
5h	24h	80h	1	1	0	—	0004h	Invalid destination element address.
5h	3Bh	85h	0	0	0	0	0000h	Requested a POSITION TO ELEMENT to park, but a cartridge was in the grab base.
5h	3Bh	86h	0	0	0	0	0000h	EXB-10h: Requested a POSITION TO ELEMENT to the tape drive, but a cartridge was in the tape drive and in the grab base. EXB-10e: Requested a POSITION TO ELEMENT to the tape drive, but the tape drive's door was closed and a cartridge was in the grab base.

Notes:

11 READ ELEMENT STATUS (B8h)

Bit Byte	7	6	5	4	3	2	1	0
00	1	0	1	1	1	0	0	0
01	Logical Unit Number			VolTag		Element Type Code		
02	(MSB)			Starting Element Address				
03								(LSB)
04	(MSB)			Number of Elements				
05								(LSB)
06	Reserved							
07	(MSB)							
08	Allocation Length							
09								(LSB)
10	Reserved							
11	0	0	Reserved				0	0

11.1 About This Command

The READ ELEMENT STATUS command allows you to obtain the status of the elements in the library. This command returns the data created as a result of the INITIALIZE ELEMENT STATUS (07h) command. For more information about the INITIALIZE ELEMENT STATUS command, see Chapter 4.

11.2 What You Send to the Library

VolTag - Byte 01, Bit 4

Since the library does not support volume tag information, you must specify a value of 0 for this field.

Element Type Code - Byte 01, Bits 3 through 0

This field allows you to specify which element type the library should report on: the CHM, the tape drive, the slots in the cartridge magazine, or all elements. The valid element type codes are listed in Table 11-1.

> **Note:** To determine if there is a cartridge in the grab base, you may want to issue a READ ELEMENT STATUS command after the library completes its power-on initialization. (Set the Element Type Code to 1h (CHM).)

Table 11-1 Valid element type codes for READ ELEMENT STATUS

This Element Type Code...	Returns information about this element type...
0h	All element types*
1h	Medium transport element (CHM)
2h	Storage element (data cartridge slots)
4h	Data transfer element (tape drive)

* For an Element Type Code of 0h, the library reports the element types in element address order beginning with the Starting Element Address.

Starting Element Address - Bytes 02 and 03

This field allows you to specify the minimum element address the library should report. Only elements with an element address greater than or equal to the starting address are reported. Element descriptors are not generated for undefined element addresses.

> **Note:** The Starting Element Address must be a valid address for the library, but does not have to be an address of the type requested in the Element Type Code. The library only returns element descriptors for the elements of the requested type within the range defined by the Starting Element Address and Number of Elements fields.

Number of Elements - Bytes 04 and 05

This field allows you to specify the maximum number of element descriptors to be returned. This is an actual number of element descriptors to be returned, not an element address range.

The library returns element descriptors of the requested element type, starting with the first element address equal to or greater than the value in the Starting Element Address field.

Allocation Length - Bytes 07 through 09

This field specifies the length in bytes of the space you are allocating for returned element descriptors. Only complete element descriptors are returned. The library returns element descriptors until one of the following conditions is met:

- All available element descriptors have been returned

  or

- The number of element descriptors specified in the Number of Elements field have been returned

  or

- The remaining allocation length is smaller than the next complete element descriptor to be returned

It may be useful to issue a READ ELEMENT STATUS command with an Allocation Length of 8 bytes. Then look at the Byte Count of Report Available field in the Element Status Data to determine how many bytes to allocate for all of the Element Status Data. (See Section 11.3 for more information about Element Status Data.)

11.3 What the Library Returns

Element Status Data

In response to the READ ELEMENT STATUS command, the library returns Element Status Data that consists of an eight-byte header followed by one or more element status pages. Each element status page consists of another eight-byte header and one or more element descriptor blocks. There is one descriptor block for each element and one page for each element type: medium transport element (CHM), storage element, and data transfer element (tape drive).

The eight-byte header for the Element Status Data is shown below. The library returns this header once for each READ ELEMENT STATUS command received.

Bit / Byte	7	6	5	4	3	2	1	0
00	(MSB)							
01			First Element Address Reported					(LSB)
02	(MSB)							
03			Number of Elements Available					(LSB)
04				Reserved				
05	(MSB)							
06			Byte Count of Report Available					
07								(LSB)
08 ⋮ *nn*				Element Status Page(s)				

First Element Address Reported - Bytes 00 and 01

This field indicates the element address of the element with the smallest element address found that meets the CDB requirements.

Number of Elements Available - Bytes 02 and 03

This field indicates the total number of element descriptors available that meet the CDB requirements. If you specified a sufficient Allocation Length in the CDB for this command, the library returns status for these elements. The value in this field will be less than or equal to the number of elements you specified in the CDB.

Byte Count of Report Available - Bytes 05 through 07

This field indicates the total number of bytes of element status data the library has available. This value is not adjusted to match the allocation length.

Element Status Page

The library returns one Element Status page for each group of element descriptors of the same type. (That is, it returns one page for each of the following: CHM, cartridge storage locations, tape drive.)

Bit Byte	7	6	5	4	3	2	1	0
00	Element Type Code							
01	PVolTag	AVolTag	Reserved					
02	(MSB)							
03	Element Descriptor Length							(LSB)
04	Reserved							
05	(MSB)							
06	Byte Count of Descriptor Data Available							
07								(LSB)
08 ⋮ *nn*	Element Descriptor(s)							

Element Type Code - Byte 00

This field indicates the specific element type being reported by this page (see Table 11-1).

PVolTag - Byte 01, Bit 7

This field indicates if primary volume tag information is present. Since the library does not support the use of primary volume tags, the value returned for this field is always 0.

AVolTag - Byte 01, Bit 6

Since the library does not support alternate volume tags, the value returned for this field is 0.

Element Descriptor Length - Bytes 02 and 03

This field indicates the total number of bytes contained in a single element descriptor. The value returned for this field is 16 bytes.

Byte Count of Descriptor Data Available - Bytes 05 through 07

This field indicates the total number of bytes of descriptor data available for the elements of this element type that meet the CDB requirements. This value is not adjusted to match the allocation length. This value is the Element Descriptor Length multiplied by the number of element descriptors.

Medium Transport Element Descriptor

The medium transport element is the cartridge handling mechanism (CHM). The library contains one CHM. The descriptor block that the library returns for the CHM is described below.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)			Element Address				
01								(LSB)
02	Reserved					Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	Reserved							
07								
08								
09	SValid	Invert	Reserved					
10	(MSB)		Source Storage Element Address					
11								(LSB)
12 ⋮ 15	Reserved							

Element Address - Bytes 00 and 01

This field contains the element address of the CHM.

Except - Byte 02, Bit 2

This field indicates the current state of the CHM. The possible values for this field are as follows:

0 – The CHM is in a normal state

1 – The CHM is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields may contain information regarding the abnormal state. Refer to Table 11-2 for more information about the abnormal state when the Except bit is set to 1.

Full - Byte 02, Bit 0

This bit indicates whether the CHM contains a cartridge, as follows:

0 – The CHM does not contain a cartridge
1 – The CHM contains a cartridge

This field is valid only if the Except bit is set to 0.

Additional Sense Code (ASC) - Byte 04

This field, together with the Additional Sense Code Qualifier field, denotes a specific error condition when the Except bit is set to 1. See Table 11-2 on page 11-13.

Additional Sense Code Qualifier (ASCQ) - Byte 05

This field, together with the Additional Sense Code field, denotes a specific error condition when the Except bit is set to 1. The ASC and ASCQ fields in the element descriptors can contain one of the values shown in Table 11-2 on page 11-13.

Storage Element Descriptor

Each of the slots in the data cartridge magazine is a storage element. The descriptor block for each of the data cartridge magazine slots is described below.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)			Element Address				
01								(LSB)
02	Reserved				Access	Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	Reserved							
07								
08								
09	SValid	Invert	Reserved					
10	(MSB)			Source Storage Element Address				
11								(LSB)
12 ⋮ 15	Reserved							

Element Address - Bytes 00 and 01

This field indicates the address of the storage slot for which the descriptor was generated.

Access - Byte 02, Bit 03

This bit indicates if the medium transport element (CHM) can access this storage element. Since the CHM can access all storage elements, this bit is always 1.

Except - Byte 02, Bit 02

This field indicates the current state of the cartridge magazine slot. The possible values for this field are as follows:

0 – The slot is in a normal state

1 – The slot is in an abnormal or questionable state and the Additional Sense Code and the Additional Sense Code Qualifier fields may contain information regarding the abnormal state. Refer to Table 11-2 for more information about the abnormal state when the Except bit is set to 1.

Full - Byte 01, Bit 00

This bit indicates whether the storage location contains a cartridge, as follows:

0 – The storage location does not contain a cartridge
1 – The storage location contains a cartridge

This field is valid only if the Except bit is set to 0.

Additional Sense Code (ASC) - Byte 04

This field, together with the Additional Sense Code Qualifier field, denotes a specific error condition when the Except bit is set to 1. See Table 11-2.

Additional Sense Code Qualifier (ASCQ) - Byte 05

This field, together with the Additional Sense Code field, denotes a specific error condition when the Except bit is set to 1. See Table 11-2.

SValid - Byte 09, Bit 07

This bit is set to 1 when the source storage element address field is valid or set to 0 when the field is not valid.

Invert - Byte 9, Bit 6

This bit is not used and is always 0.

Source Storage Element Address - Bytes 10 and 11

This field shows the address of the last storage element from which the cartridge was moved.

Data Transfer Element Descriptor

The data transfer element is the tape drive. The descriptor block for the tape drive is described below.

Byte \ Bit	7	6	5	4	3	2	1	0
00	(MSB)			Element Address				
01								(LSB)
02		Reserved			Access	Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	NotBus	RSVD	IDValid	LUValid	RSVD	Logical Unit Number		
07	SCSI Bus Address							
08	Reserved							
09	SValid	Invert	Reserved					
10	(MSB)			Source Storage Element Address				
11								(LSB)
12 ⋮ 15	Reserved							

Element Address - Bytes 00 and 01

This field contains the address of the data transfer element (the tape drive).

Access - Byte 02, Bit 3

This field indicates access to the tape drive by the CHM, as follows:

0 – The CHM cannot access the tape drive
1 – The CHM can access the tape drive

Except - Byte 02, Bit 2

This field indicates the current state of the tape drive. The possible values for this field are as follows:

0 – The tape drive is in a normal state

1 – The tape drive is in an abnormal or questionable state and the Additional Sense Code and the Additional Sense Code Qualifier fields may contain information regarding the abnormal state. Refer to Table 11-2 for more information about the abnormal state when the Except bit is set to 1.

Full - Byte 02, Bit 0

This bit indicates whether the tape drive contains a data cartridge, as follows:

0 – The tape drive does not contain a data cartridge
1 – The tape drive contains a data cartridge

This field is valid only when the Except bit is set to 0.

Additional Sense Code (ASC) - Byte 04

If the tape drive is in an abnormal state, this field contains the value 90h. Refer to Table 11-2 on page 11-13 for the corresponding ASCQ values and a corrective action for each abnormal state.

Additional Sense Code Qualifier (ASCQ) - Byte 05

The values for this field are listed in Table 11-2 on page 11-13, along with the corrective action to take for each abnormal state.

NotBus - Byte 06, Bit 7

This field is not supported and is always 0.

IDValid - Byte 06, Bit 5

This field is not supported and is always 0.

LUValid - Byte 06, Bit 4

This field is not supported and is always 0.

Logical Unit Number - Byte 06, Bits 2 through 0

This field is not supported and is always 0.

SCSI Bus Address - Byte 07

This field indicates the SCSI bus address of the tape drive. The value is equal to the tape drive's SCSI ID displayed on the library's LCD.

> **Notes:**
>
> - If you change the tape drive's SCSI ID from the LCD but do not power cycle the tape drive (turn the library off then back on), the library will report the new SCSI ID, but the tape drive will respond only to the old SCSI ID.
>
> - **EXB-10e only:** This field is not supported if an EXB-8200 without a remote switch for setting the SCSI ID is installed.

SValid - Byte 09, Bit 7

This field indicates if the Source Storage Element Address field is valid, as follows:

0 – Source Storage Element Address field is not valid.
1 – Source Storage Element Address field is valid.

Invert - Byte 09, Bit 6

The library uses single-sided media and does not support inverting of the media (recording on both sides of the tape). The value reported for this field is always 0.

Source Storage Element Address - Bytes 10 and 11

This field indicates the address of the last storage element from which the cartridge was moved. This field is only valid if the SValid bit is 1.

ASC and ASCQ Values for Abnormal States

Table 11-2 contains a list of the ASC and ASCQ values that will appear in the Additional Sense Code and Additional Sense Code Qualifier fields of an element descriptor if the element is in an abnormal state. The Except field of an element descriptor indicates if the element is in an abnormal state.

Table 11-2 also indicates the corrective action for each abnormal state.

Table 11-2 ASC and ASCQ values for abnormal element conditions

ASC	ASCQ	Description	Action
90h	02h	Cartridge magazine is missing.	Install a cartridge magazine.
90h	03h	Status is questionable.	The library was powered on, a bus device reset occurred, or the library was opened. The data cartridge inventory may have been violated.

11.4 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 11-1 shows the steps that the library takes when executing the command through the bus free phase. As shown in the figure, the library validates the parameters in the CDB. Table 11-3 shows the sense data reported for invalid parameters in the CDB.

Note: This section describes the normal processing of the command through the bus free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a message out phase.
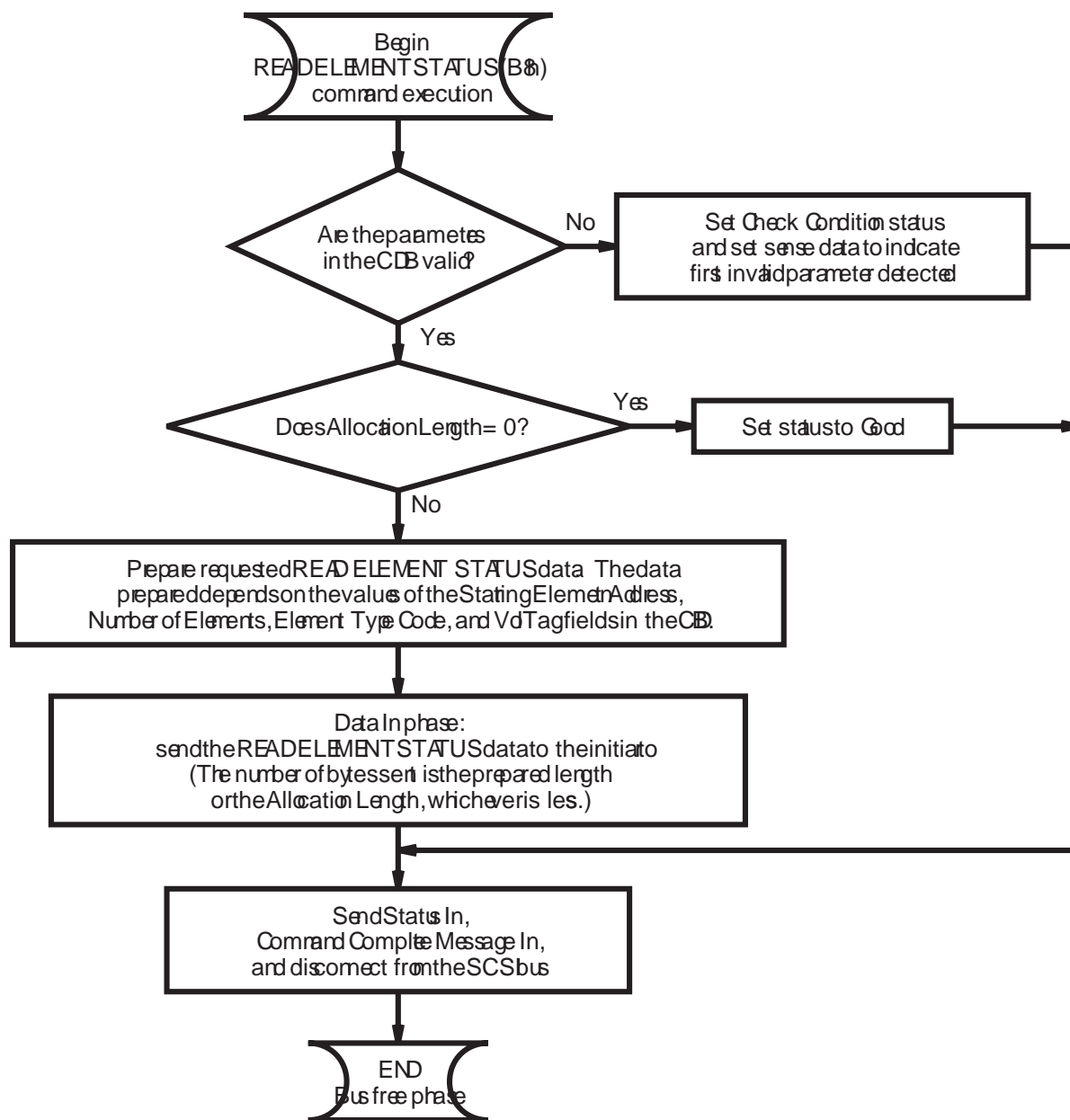
Figure 11-1 READ ELEMENT STATUS command execution

11.5 Command Status

The library returns a status byte after processing the READ ELEMENT STATUS command.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 15 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.

- The library detects an unrecoverable parity error while receiving the CDB.

- The command is issued to an invalid LUN.

- A Unit Attention condition is pending for the initiator.

- The library is not ready because the door is open, or it is operating in sequential mode, LCD mode, or CHS Monitor mode.

- A reserved bit is set to 1 in the CDB.

- A parameter in the CDB is invalid (see Table 11-3 for sense data).

Table 11-3 Invalid parameters in the READ ELEMENT STATUS CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	21h	01h	1	1	0	0	0002h	Invalid starting element address.
5h	24h	00	1	1	1	3h	0001h	Invalid element type code.
5h	24h	00	1	1	1	4h	0001h	Invalid VolTag value.

12 RECEIVE DIAGNOSTIC RESULTS (1Ch)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	1	0	0
01	Logical Unit Number			Reserved				
02	Reserved							
03	(MSB)			Allocation Length				
04								(LSB)
05	0	0	Reserved				0	0

12.1 About This Command

The RECEIVE DIAGNOSTIC RESULTS command requests that the library return data obtained by the execution of the SEND DIAGNOSTIC (1Dh) command. The information that the RECEIVE DIAGNOSTIC RESULTS command returns depends on the diagnostic test you requested using the SEND DIAGNOSTIC command. If you issue a RECEIVE DIAGNOSTIC RESULTS command after a successful SEND DIAGNOSTIC command, the library will return one of the following diagnostic pages:

- Tape Drive Calibration page (80h)
- Cartridge Sensor Calibration page (81h)
- Eject Position Calibration page (82h)

Notes:

- In a multi-initiator environment, you should reserve the entire library using the RESERVE (16h) command before you request diagnostic data. Do not issue the RELEASE (17h) command until after you have successfully obtained data with the RECEIVE DIAGNOSTIC RESULTS command. The order in which you should issue commands is as follows:

  1. RESERVE (16h) for the entire library
  2. SEND DIAGNOSTIC (1Dh)
  3. RECEIVE DIAGNOSTIC RESULTS (1Ch)
  4. RELEASE (17h)

- If you requested a pick and place functionality test or a redefinition of home in the previous SEND DIAGNOSTIC command, a subsequent RECEIVE DIAGNOSTIC RESULTS command **will not** return a results page. The command status returned for the SEND DIAGNOSTIC command is the only result you receive.

12.2 What You Send to the Library

Allocation Length - Bytes 03 and 04

This field allows you to specify the number of bytes that you are allocating for diagnostic data. If you do not want the library to transfer diagnostic data, set this field to 0.

The library terminates the data in phase either when the number of bytes specified by the Allocation Length field have been transferred or when all available diagnostic data has been transferred to the initiator, whichever is less.

12.3 What the Library Returns

Supported Diagnostics Page (00h)

The Supported Diagnostics Page contains all diagnostic page codes that the library implements in ascending order, beginning with page code 00h.

Bit Byte	7	6	5	4	3	2	1	0
00	Page Code							
01	Reserved							
02	(MSB)							
03	Page Length (6h)							(LSB)
04	00h - Supported Diagnostics							
05	80h - Tape Drive Calibration							
06	81h - Cartridge Sensor Calibration							
07	82h - Eject Position Calibration							
08	83h - Pick and Place Functionality (results not returned by this command)							
09	84h - Redefinition of Home (results not returned by this command)							

Page Length - Bytes 02 and 03

The Page Length field specifies the length in bytes of the supported page list. This value is 6h.

Supported Page List - Bytes 04 through 09

These bytes list the diagnostic pages supported by the library.

Tape Drive Calibration Page (80h)

If you requested a tape drive calibration in the previous SEND DIAGNOSTIC command, the library returns the Tape Drive Calibration page in response to a subsequent RECEIVE DIAGNOSTIC RESULTS command.

Notes:

- If the CHM or the tape drive is reserved, the library returns a command status of Reservation Conflict.

- The EXB-10h does not perform tape drive calibration. However, it does return valid information for the Tape Drive Calibration page.

Bit Byte	7	6	5	4	3	2	1	0
00	Page Code (80h)							
01	Reserved							
02 03	Page Length (18h)							
04 ⋮ 07	(MSB) Upper Bound of Tape Drive Vertical Position (LSB)							
08 ⋮ 11	(MSB) Lower Bound of Tape Drive Vertical Position (LSB)							
12 ⋮ 15	(MSB) Calibrated Tape Drive Vertical Position (LSB)							
16 ⋮ 19	(MSB) Upper Bound of Tape Drive Horizontal Position (LSB)							
20 ⋮ 23	(MSB) Lower Bound of Tape Drive Horizontal Position (LSB)							
24 ⋮ 27	(MSB) Calibrated Tape Drive Horizontal Position (LSB)							

Page Length - Bytes 02 and 03

The Page Length field specifies the length in bytes of the Tape Drive Calibration page. The value for this field is 24 (18h).

Upper Bound of Tape Drive Vertical Position - Bytes 04 through 07

This field defines an upper bound of possible tape drive vertical positions in servo counts.

Lower Bound of the Tape Drive Vertical Position - Bytes 08 through 11

This field defines a lower bound of possible tape drive vertical positions.

Calibrated Tape Drive Vertical Position - Bytes 12 through 15

This field defines the calibrated vertical position of the tape drive.

Upper Bound of Tape Drive Horizontal Position - Bytes 16 through 19

This field defines an upper bound of possible tape drive horizontal positions.

Lower Bound of the Tape Drive Horizontal Position - Bytes 20 through 23

This field defines a lower bound of possible tape drive horizontal positions.

Calibrated Tape Drive Horizontal Position - Bytes 24 through 27

This field defines the calibrated horizontal position of the tape drive.

Cartridge Sensor Calibration Page (81h)

If you requested a cartridge sensor calibration in a previous SEND DIAGNOSTIC command, the library returns the Cartridge Sensor Calibration page in response to a subsequent RECEIVE DIAGNOSTIC RESULTS command.

Bit Byte	7	6	5	4	3	2	1	0
0	Page Code (81h)							
1	Reserved							
2	Page Length (0Ch)							
3								
4	(MSB)							
⋮	Upper Bound for Cartridge Sensor Position							
7								(LSB)
8	(MSB)							
⋮	Lower Bound for Cartridge Sensor Position							
11								(LSB)
12	(MSB)							
⋮	Calibrated Cartridge Sensor Position							
15								(LSB)

Page Length - Bytes 02 and 03

The Page Length field specifies the length in bytes of the Cartridge Sensor Calibration page. The value returned for this field is 12 (0Ch).

Upper Bound for Cartridge Sensor Position - Bytes 04 through 07

This field defines an upper bound of possible cartridge sensor positions in servo counts.

Lower Bound for Cartridge Sensor Position - Bytes 08 through 11

This field defines a lower bound of possible cartridge sensor positions.

Calibrated Cartridge Sensor Position - Bytes 12 through 15

This field defines the calibrated cartridge sensor position on the CHM.

Eject Position Calibration Page (82h)

If you requested an eject position calibration in a previous SEND DIAGNOSTIC command, the library returns the Eject Position Calibration page in response to a subsequent RECEIVE DIAGNOSTIC RESULTS command.

Bit Byte	7	6	5	4	3	2	1	0
0	Page Code (82h)							
1	Reserved							
2	Page Length (0Ch)							
3								
4 ⋮ 7	Upper Bound for Eject Position							
8 ⋮ 11	Lower Bound for Eject Position							
12 ⋮ 15	Calibrated Eject Position							

Page Length - Bytes 02 and 03

The Page Length field specifies the length in bytes of the Eject Position Calibration page. The value for this field is 12 (0Ch).

Upper Bound for Eject Position - Bytes 04 through 07

This field defines an upper limit of possible eject positions in servo counts.

Lower Bound for Eject Position - Bytes 08 through 11

This field defines a lower limit of possible eject positions.

Calibrated Eject Position - Bytes 12 through 15

This field defines the horizontal eject position.

12.4 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 12-1 shows the steps that the library takes when executing the command through the bus free phase.

> **Note**: This section describes the normal processing of the command through the bus free phase. Additional processing may occur if the message system is enabled and the library response to ATN with a message out phase.

```
                    ┌─────────────────────────┐
                    │          Begin          │
                    │ RECEIVE DIAGNOSTIC RESULTS (1Ch) │
                    │     command execution    │
                    └─────────────────────────┘
                                │
                                ▼
                          ╱─────────╲                              ┌─────────────────────────────┐
                        ╱             ╲          No                │ Set Check Condition status and │
                      ╱  Are the parameters in ╲ ─────────────────▶│ set sense data to indicate the │
                      ╲  the CDB valid?        ╱                   │ first invalid parameter detected │
                        ╲             ╱                            └─────────────────────────────┘
                          ╲─────────╱
                                │ Yes
                                ▼
                          ╱─────────╲              Yes             ┌─────────────────────────────┐
                        ╱  Does Allocation ╲ ───────────────────▶  │      Set status to Good       │
                        ╲  Length = 0?      ╱                      └─────────────────────────────┘
                          ╲─────────╱
                                │ No
                                ▼
              ┌─────────────────────────────────┐
              │ Data In phase: return the RECEIVE │
              │ DIAGNOSTIC RESULTS to the initiator│
              │ (The library returns the prepared │
              │ length or the number of bytes     │
              │ specified by the Allocation Length,│
              │ whichever is less.)               │
              └─────────────────────────────────┘
                                │
                                ▼
              ┌─────────────────────────────────┐
              │          Send Status In,          │
              │   Command Complete Message In,    │
              │  and disconnect from the SCSI bus │
              └─────────────────────────────────┘
                                │
                                ▼
                          ┌───────────┐
                          │    END     │
                          │ Bus free phase │
                          └───────────┘
```

Figure 12-1 RECEIVE DIAGNOSTIC RESULTS command execution

12.5 Command Status

The library returns a status byte after processing the RECEIVE DIAGNOSTIC RESULTS command.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 15 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.

- The library detects an unrecoverable parity error while receiving the CDB.

- The command is issued to an invalid LUN.

- A Unit Attention condition is pending for the initiator.

- A reserved bit is set to 1 in the CDB.

Table 12-1 Invalid parameters in the RECEIVE DIAGNOSTIC RESULTS CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	0	1	1	1	—	—	Reserved bit set to 1 in CDB. The bit pointer and field pointer indicate the bit in error.

13 RELEASE (17h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	1
01	Logical Unit Number			3rdPty	Third Party Device ID			Element
02	Reservation Identification							
03	Reserved							
04								
05	0	0	Reserved				0	0

13.1 About This Command

The RELEASE command enables you to release reservations of the library or elements of the library as set by the RESERVE (16h) command. For information on the RESERVE command, see Chapter 15. For default element addresses, refer to Chapter 1.

Releasing an unreserved library or unreserved elements of the library is not an error.

Only the initiator that reserved the library or library elements can release the reserved library or elements. If another initiator attempts to release a reserved library or element, the library returns Good status but does not release the element or library.

13.2 What You Send to the Library

3rdPty - Byte 01, Bit 4

Because the library does not support third party operations, the value for this field must be 0.

Third Party Device ID - Byte 01, Bits 3 through 1

Because the library does not support third party reservations, the value for this field must be 0.

Element - Byte 01, Bit 0

The valid values for this field are as follows:

0 – Release the library or any reserved elements from reserved status

1 – Release the reserved elements associated with the Reservation Identification (byte 02) from reserved status

Reservation Identification - Byte 02

This field specifies a value established by the initiator to identify the specific reservation request (see Chapter 15). If the Element field (byte 01, bit 0) is 0, this field is ignored.

13.3 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 13-1 shows the steps that the library takes when executing the command through the bus free phase. As shown in the figure, the library validates the parameters in the CDB. Table 13-1 shows the sense data reported for invalid parameters in the CDB.

Note: The section describes the normal processing of the command through the bus free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a message out phase.
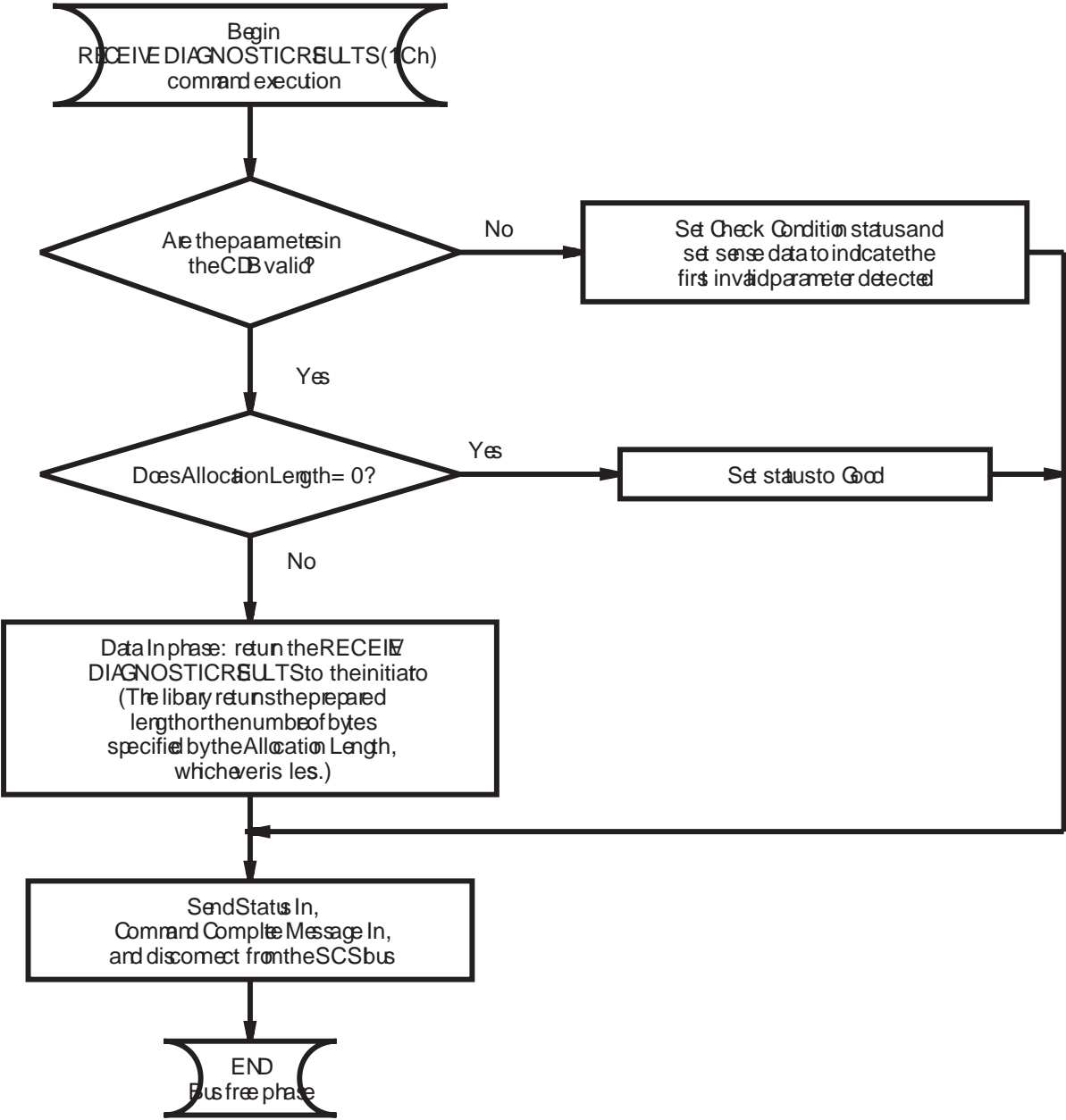
Begin
RELEASE (17h) command execution

Are the parameters
in the CDB valid?

No → Set Check Condition status
and set sense data to indicate
first invalid parameter detected

Yes

Does Element = 1?

Yes →

No

Clear all element reservations
by this initiator, independent
of the Reservation ID in the CDB

(The element reservations are
stored in the cartridge inventory.)

Clear all element reservations
by this initiator with the same
Reservation ID as in the CDB

(The element reservations are
stored in the cartridge inventory.)

Is the library reserved
as a unit by this initiator?

No →

Yes

Clear the unit reservation

Send Status In,
Command Complete Message In,
and disconnect from the SCSI bus

END
Bus free phase

Figure 13-1 RELEASE command execution

13.4 Command Status

The library returns a status byte after processing the RELEASE command.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library never returns Reservation Conflict status for the RELEASE command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.

- The library detects an unrecoverable parity error while receiving the CDB.

- The command is issued to an invalid LUN.

- A Unit Attention condition is pending for the initiator.

- A reserved bit is set to 1 in the CDB.

- A parameter in the CDB is invalid (see Table 13-1 for sense data).

Table 13-1 Invalid parameters in the RELEASE CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00	1	1	1	4h	0001h	Error in 3rdPty field.
5h	24h	00	1	1	1	3h	0001h	Error in Third Party Device ID field.

14 REQUEST SENSE (03h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	1	1
01	Logical Unit Number			Reserved				
02	Reserved							
03								
04	Number of Bytes Allocated							
05	0	0	Reserved				0	0

14.1 About This Command

The REQUEST SENSE command requests that the library transfer sense data to the initiator. The library provides sense data in only the Error Code 70h, extended sense data format. The library returns a total of 18 bytes of sense data to the initiator.

The sense data is constructed and saved on a per-initiator and requested LUN basis. The library preserves sense data for all initiators until the data is retrieved by the REQUEST SENSE command or until the library receives any other command for the same I_T_L nexus (initiator-target-LUN connection).

Sense data is available under the following circumstances:

- The previous command to the specified I_T_L nexus terminated with Check Condition status.

- The previous command to the specified I_T_L nexus terminated with an unexpected bus free error.

■ The REQUEST SENSE command was issued to an unsupported LUN. In this case, the library does not return Check Condition status and returns the following sense data:

Sense key	Illegal Request (5h)
ASC	Logical unit not supported (25h)
ASCQ	0

If no sense data is available for the specified I_T_L nexus, the library returns the following sense data:

Sense key	No Sense (0h)
ASC	No additional sense information (00h)

14.2 What You Send to the Library

Number of Bytes Allocated - Byte 04

This field allows you to specify the number of bytes that the initiator has allocated for returned sense data. The library provides a total of 18 (12h) bytes of sense data.

14.3 What the Library Returns

Sense Data

The library returns the standard extended sense bytes, as described below.

Bit Byte	7	6	5	4	3	2	1	0
00	RSVD	1	1	1	0	0	0	0
01	0							
02	0	0	0	RSVD	Sense Key			
03 ⋮ 06	(MSB) Information Bytes (LSB)							
07	Additional Sense Length							
08 ⋮ 11	(MSB) Command Specific Information (LSB)							
12	Additional Sense Code (ASC)							
13	Additional Sense Code Qualifier (ASCQ)							
14	Field Replaceable Unit Code							
15	SKSV	(MSB)						
16	Sense Key Specific							
17	(LSB)							

Sense Key - Byte 02, Bits 3 through 0

Table 14-1 contains descriptions of the sense key values supported by the library. For a list of the conditions that cause each sense key setting, refer to Appendix D.

Table 14-1 Sense key descriptions

Hex Value	Sense Key	Description
0h	No Sense	Indicates that there is no specific sense key information to be reported for the library.
2h	Not Ready	Indicates that the library is not ready to perform CHM motion commands.
4h	Hardware Error	Indicates that the library detected a hardware failure while performing the command or during a self-test. Operator intervention may be required.
5h	Illegal Request	Indicates that there was an illegal parameter in the command descriptor block or in the additional parameters supplied as data for a command, or the library is in the wrong mode to execute the command.
6h	Unit Attention	Indicates that the cartridge inventory may have been violated.
Bh	Aborted Command	Indicates that the library aborted the command. The initiator may be able to recover by trying the command again.

Information Bytes - Bytes 03 through 06

The library does not support this sense field. The value returned is 0.

Additional Sense Length - Byte 07

This byte indicates the Additional Sense Length provided by the library excluding this byte. The value returned is 0Ah.

Command Specific Information - Bytes 08 through 11

This field is not supported by the library. The value returned is 0.

Additional Sense Code (ASC) - Byte 12

This field, together with the Additional Sense Code Qualifier (byte 13), denotes a specific error condition. For a list of these error conditions, refer to Appendix D.

Additional Sense Code Qualifier (ASCQ) - Byte 13

This field, together with the Additional Sense Code (byte 12), denotes a specific error condition. For a list of these error conditions, refer to Appendix D.

Field Replaceable Unit Code - Byte 14

This field is not supported by the library. The value returned is 0.

SKSV (Sense Key Specific Valid) - Byte 15, Bit 7

When this bit is set to 1, the information in the Sense Key Specific field is valid. The SKSV field can be set to 1 only for a sense key of Illegal Request (5h).

Sense Key Specific - Byte 15, Bits 6 through 0; Bytes 16 and 17

When the SKSV bit is set to 1, the information contained in this field indicates which field in the CDB or parameter list of a command caused the Check Condition status. This field, valid only for a sense key of Illegal Request (5h), is defined as shown in Table 14-2.

Table 14-2 Meaning of Sense Key Specific field for Illegal Request (5h)

Bit / Byte	7	6	5	4	3	2	1	0
15	SKSV	C/D	Reserved		BPV	Bit Pointer		
16	(MSB)	Field Pointers						
17								(LSB)

C/D (Command/Data) - Byte 15, Bit 6 Indicates whether the Check Condition status resulted from an illegal parameter in either the command descriptor block (Command) or the parameter list (Data) of a particular command, as follows:

0 – The Check Condition status resulted from an illegal parameter in the parameter list (Data)

1 – The Check Condition status resulted from an illegal parameter in the command descriptor block (Command)

BPV (Bit Pointer Valid) - Byte 15, Bit 3   Indicates whether the value in the Bit Pointer field is valid, as follows:

0 – The value contained in the Bit Pointer is not valid

1 – The value contained in the Bit Pointer (byte 15, bits 2 through 0) is valid

The value in the Bit Pointer field is valid when the field of the CDB or parameter list that caused the error is less than one byte long.

Bit Pointer - Byte 15, Bits 2 through 0   Specifies the bit of the byte identified by the Field Pointer (bytes 16 and 17). When a multiple-bit field is in error, the Bit Pointer contains the value of the most significant bit of the field. The most significant bit of a multiple-bit field is the bit with the highest bit number. For example, if a field consists of bits 5, 4, and 3, the most significant bit is bit 5.

Field Pointer - Bytes 16 and 17   Contains the number of the byte in which the error occurred. Byte numbers start at 00. When a multiple-byte field is in error, the Field Pointer contains the value of the most significant byte of the field. The most significant byte of a multiple-byte field is the byte with the lowest byte number. For example, if a field consists of bytes 02, 03, and 04, the most significant byte is byte 02.

Priorities of Sense Bytes

Multiple errors may occur during the processing of a single SCSI command. The sense key reflects the last error that occurred. For example, if a message error occurs after an unrecoverable hardware error, the library handles the errors in the following manner:

■ The message error is reported.

■ The hardware error is preserved, and the next motion command issued by any host terminates with Check Condition status.

■ A subsequent REQUEST SENSE command reports the hardware error.

Sense Byte Pending Status

When the library reports Check Condition status in response to a command from an initiator, the library retains the sense byte pending status, including error information and Check Condition status for the initiator, until one of the following occurs:

■ Error information is reset by the next command execution for the same initiator

■ Error information is reset by a Bus Device Reset message or a SCSI bus reset condition.

Selection Without an Initiator ID

If the library is selected without the initiator's ID on the bus, it cannot disconnect from the SCSI bus because it does not know which initiator to reconnect to during reselection.

The library has space allocated for eight sets of sense data, allowing it to preserve sense data for up to seven initiators and for the library itself. The library retrieves the sense data based on the initiator ID when a REQUEST SENSE (03h) command is issued.

The space that is set aside for the library is not used for library sense data, but is used to save sense data created during execution of commands requested by an unknown initiator. Therefore, if the library is selected without the initiator's ID on the bus and that initiator requests a command that ends with Check Condition status, the same initiator can again select the library without its ID on the bus and get the correct sense data using the REQUEST SENSE (03h) command.

14.4 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 14-1 shows the steps that the library takes when executing the command through the bus free phase. As shown in the figure, the library validates the parameters in the CDB.

> **Note:** The section describes the normal processing of the REQUEST SENSE command through the bus free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a message out phase.
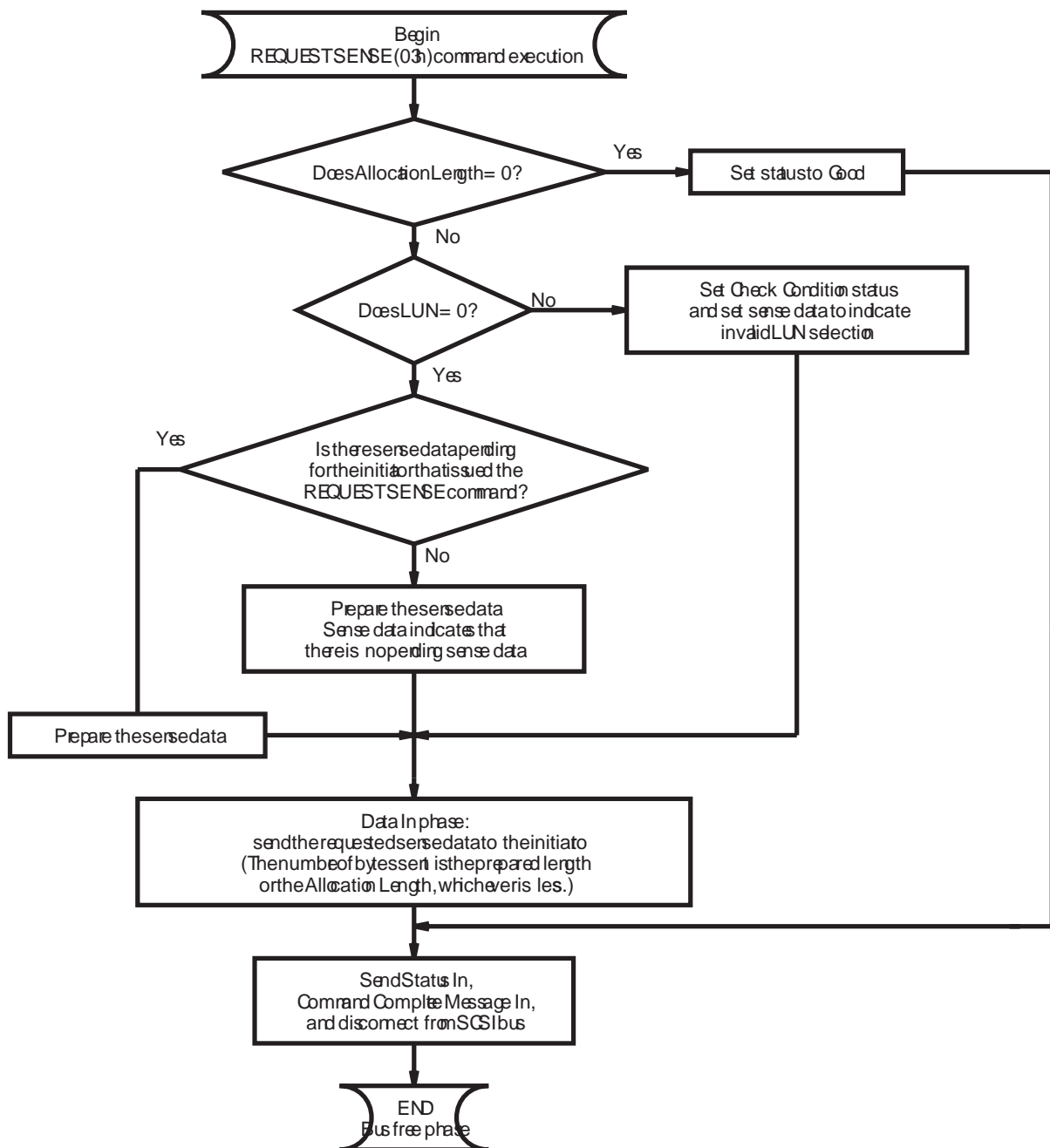
```
                    ⎛  Begin                    ⎞
                    ⎝ REQUEST SENSE (03h) command execution ⎠
                             │
                             ▼
                    ╱◇╲  Does Allocation Length = 0?  ╲◇╱ ──── Yes ──→  ┌─────────────────────┐
                             │                                           │  Set status to Good │
                            No                                          └─────────────────────┘
                             │                                                     │
                             ▼                                                     │
                    ╱◇╲  Does LUN = 0?  ╲◇╱ ──── No ──→  ┌──────────────────────────────────┐
                             │                            │  Set Check Condition status       │
                            Yes                           │  and set sense data to indicate   │
                             │                            │  invalid LUN selection            │
                             ▼                            └──────────────────────────────────┘
          Yes ── ╱◇╲  Is there sense data pending ╲◇╱
                      for the initiator that issued the
                      REQUEST SENSE command?
                             │
                            No
                             │
                             ▼
                    ┌──────────────────────────────┐
                    │  Prepare the sense data       │
                    │  Sense data indicates that    │
                    │  there is no pending sense data│
                    └──────────────────────────────┘
  ┌──────────────────────┐
  │ Prepare the sense data│
  └──────────────────────┘
                             ▼
                    ┌──────────────────────────────────────────────┐
                    │  Data In phase:                               │
                    │  send the requested sense data to the initiator│
                    │  (The number of bytes sent is the prepared length│
                    │   or the Allocation Length, whichever is less.)│
                    └──────────────────────────────────────────────┘
                             ▼
                    ┌──────────────────────────────────────┐
                    │  Send Status In,                      │
                    │  Command Complete Message In,         │
                    │  and disconnect from SCSI bus         │
                    └──────────────────────────────────────┘
                             ▼
                    ⎛  END          ⎞
                    ⎝ Bus free phase ⎠
```

Figure 14-1 REQUEST SENSE command execution

14.5 Command Status

The library returns a status byte after processing the REQUEST SENSE command.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library never returns Busy status for the REQUEST SENSE command.

Reservation Conflict

The library never returns Reservation Conflict status for the REQUEST SENSE command.

Check Condition

The library returns Check Condition status for the following reasons:

■ The message system is enabled and a message error occurs while the library is processing the command.

■ The library detects an unrecoverable parity error while receiving the CDB.

■ A reserved bit is set to 1 in the CDB.

15 RESERVE (16h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	0
01	Logical Unit Number			3rdPty	Third Party Device ID			Element
02	Reservation Identification							
03	(MSB)			Element List Length				
04								(LSB)
05	0	0	Reserved				0	0

15.1 About This Command

The RESERVE command allows the initiator to perform two types of reservations:

- Unit reservation — reservation of the library as a whole.

- Element reservation — reservation of specific elements of the library, including data cartridge slots, the tape drive, and the CHM.

Reservations can be released with a RELEASE (17h) command from the same initiator, a Bus Device Reset message, a SCSI bus reset, an operator panel reset, or a power-on reset of the library.

To modify or supersede a previous element reservation, issue a RESERVE command with the same Reservation Identification. If the superseding reservation does not result in any reservation conflicts or error conditions, the library releases the previous reservation and completes the new reservations. A unit reservation of the library will supersede any previous element reservations by the same initiator.

Notes:

- If the library is reserved as a unit, the library processes only the following commands from another initiator:

  - INQUIRY
  - RELEASE
  - REQUEST SENSE

  All other commands result in a Reservation Conflict (18h) status.

- If an initiator has reserved at least one element, another initiator cannot do the following:

  - Issue a MODE SELECT command that changes any element addresses. If the library receives such a command, it returns a Reservation Conflict (18h) status to the initiator.

  - Move a data cartridge to or from that element.

- Position the grab base to that element.

15.2 What You Send to the Library

3rdPty - Byte 01, Bit 4

Because the library does not support third party reservations, the value for this field must be 0.

Third Party Device ID - Byte 01, Bits 3 through 1

Because the library does not support third party reservations, the value for this field must be 0.

Element - Byte 01, Bit 0

This field specifies whether you are reserving the entire library or a series of library elements, as follows:

0 – Reserve the entire library.

1 – Reserve a series of elements identified by the Reservation Identification field (byte 02) and specified by the Element List Descriptor.

Reservation Identification - Byte 02

This field allows you to assign an identification number to a reservation request that reserves a series of elements. You can assign any one-byte number you want. You can use this number with the RELEASE (17h) command to release the same series of elements (see Chapter 13 for more information).

Element List Length - Bytes 03 and 04

This field specifies the total length in bytes of the element list descriptors that you are sending. Each element list descriptor is 6 bytes, so the valid values for this field are 0, 6, and increments of 6.

The maximum value for this field is 72 (12×6), where 12 is the maximum number of elements in the library and 6 is the number of bytes required for each element list descriptor.

If the Element field (byte 01, bit 0) is 0, this field is ignored. If the Element field is 1 and the value for the Element List Length is 0, no elements are reserved.

Element List Descriptor

After sending the RESERVE CDB, you send zero or more Element List Descriptors to reserve specific library elements.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved							
01								
02	(MSB)	Number of Elements						
03								(LSB)
04	(MSB)	Element Address						
05								(LSB)

Number of Elements - Bytes 02 and 03

This field allows you to specify the number of elements to be reserved. If you specify a value of 0 for this field, all elements starting at the Element Address (bytes 04 and 05) through the last element address for the library are reserved.

Element Address - Bytes 04 and 05

This field allows you to specify the element or the starting address of a series of elements to be reserved. (See Figure 1-1 on page 1-5 for the default element addresses.)

15.3 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

The actions that the library takes for the RESERVE command depend on whether the request is for a unit reservation or an element reservation. Figure 15-1 shows the action that the library takes for a request to reserve the entire library as a unit. Figure 15-2 shows the action that the library takes for a request to reserved an element or group of elements.

As shown in Figure 15-1 and Figure 15-2, the library validates the parameters in the CDB and the element descriptor data. Table 15-1 shows the sense data reported for invalid parameters in the CDB and in the element descriptor data.

Note: This section describes the normal processing of the command through the bus free phase. Additional processing may occur if the message system is enabled and the library responds to ATN with a message out phase.
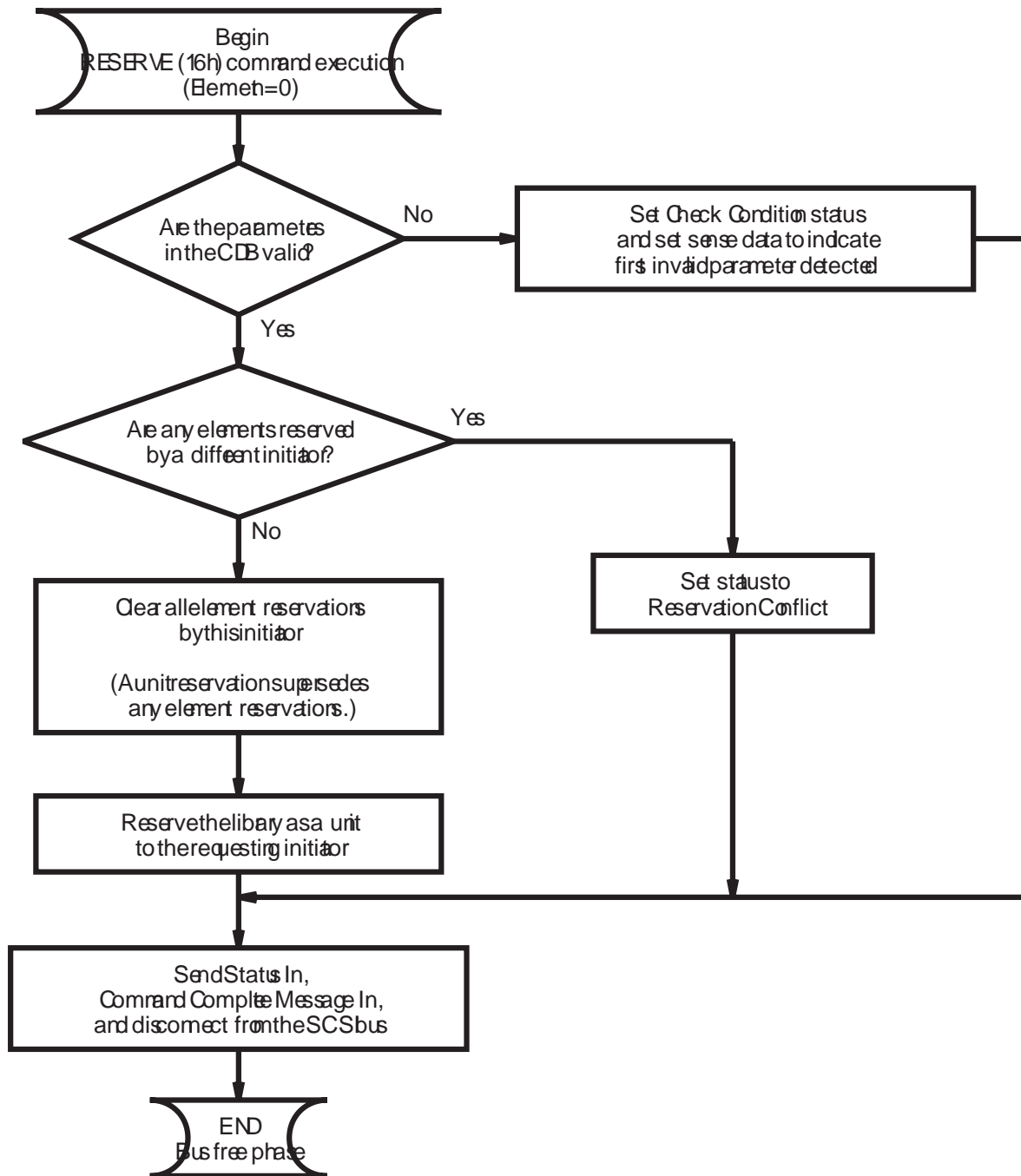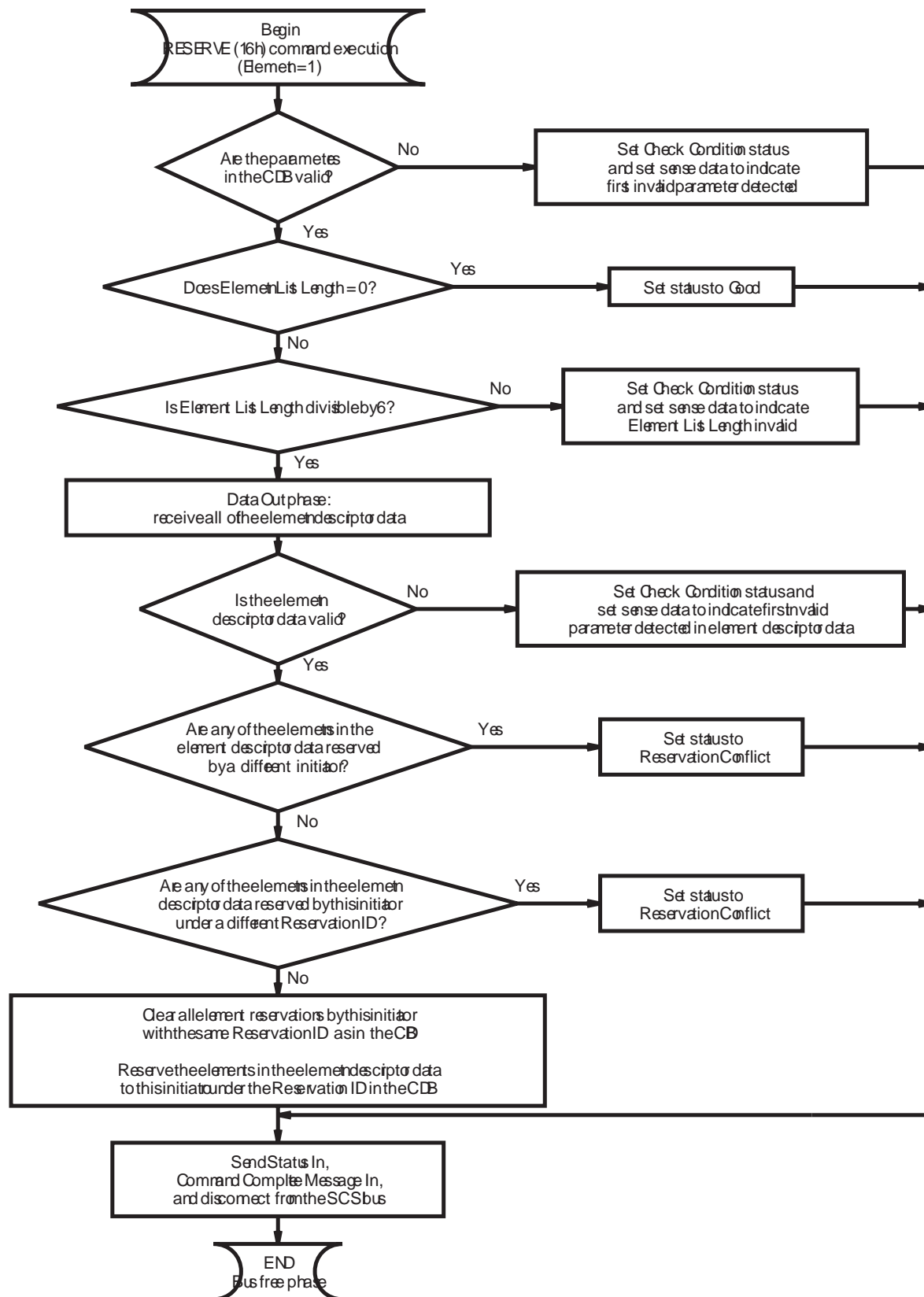
Begin
RESERVE (16h) command execution
(Element = 0)

Are the parameters
in the CDB valid?

No → Set Check Condition status
and set sense data to indicate
first invalid parameter detected

Yes

Are any elements reserved
by a different initiator?

Yes → Set status to
Reservation Conflict

No

Clear all element reservations
by this initiator

(A unit reservation supersedes
any element reservations.)

Reserve the library as a unit
to the requesting initiator

Send Status In,
Command Complete Message In,
and disconnect from the SCS bus

END
Bus free phase

Figure 15-1 RESERVE command execution—unit reservation

Figure 15-2 RESERVE command execution—element reservation

15.4 Command Status

The library returns a status byte after processing the RESERVE command.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when:

- The library is reserved by a different initiator

- An initiator attempts to reserve an element that is reserved by a different initiator

- An initiator attempts to reserve an element it has already reserved under a different Reservation Identification

If an element address has already been reserved by another initiator, none of the requested elements is reserved, Reservation Conflict (18h) status is returned to the initiator, and the sense key is set to No Sense (0h).

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.

- The library detects an unrecoverable parity error while receiving either the CDB or the element descriptor data.

- The command is issued to an invalid LUN.

- A Unit Attention condition is pending for the initiator.

■ A reserved bit is set to 1 in the CDB.

■ A parameter in the CDB or element descriptor data is invalid (see Table 15-1 for sense data).

Table 15-1 Invalid parameters in the RESERVE CDB and element descriptor data

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	1Ah	00h	1	1	0	0	0003h	Invalid Element List Length.
5h	24h	00h	1	1	1	4h	0001h	Error in 3rdPty field.
5h	24h	00h	1	1	1	3h	0001h	Error in Third Party Device field.
5h	26h	00h	1	0	0	0	0000h*	Reserved field not 0.
5h	26h	00h	1	0	0	0	0001h*	Reserved field not 0.
5h	26h	02h	1	0	0	0	0004h*	Invalid element address.

* You can send more than one Element List Descriptor at a time. Add 6 to this field pointer value for each subsequent descriptor.

16 SEND DIAGNOSTIC (1Dh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	1	0	1
01	Logical Unit Number			PF	RSVD	SelfTest	DevOfl	UnitOfl
02	Reserved							
03	Parameter List Length							
04								
05	0	0	Reserved				0	0

16.1 About This Command

The SEND DIAGNOSTIC command instructs the library to perform diagnostic tests on itself or to perform individual diagnostic procedures that you specify in the parameter list of this command.

The library can perform the following diagnostic tests:

- Redefinition of home on the horizontal and vertical axes
- Cartridge sensor calibration procedure
- Tape drive calibration procedure
- Eject position calibration procedure
- Verification of the library pick-and-place procedures

If disconnect is allowed, the library disconnects from the SCSI bus when it performs any diagnostic tests.

Notes:

■ The EXB-10h does not perform tape drive calibration. If requested to do so through the SEND DIAGNOSTIC command, the EXB-10h returns Good status but performs no action.

■ In a multi-initiator environment, you should reserve the entire library using the RESERVE (16h) command before you request diagnostic data. Do not issue the RELEASE (17h) command until after you have successfully obtained data with the RECEIVE DIAGNOSTIC RESULTS command. The order in which you should issue commands is as follows:

1. RESERVE (16h)
2. SEND DIAGNOSTIC (1Dh)
3. RECEIVE DIAGNOSTIC RESULTS (1Ch)
4. RELEASE (17h)

16.2 What You Send to the Library

PF (Page Format) - Byte 01, Bit 4

The value for this field must always be 1 to indicate that the SEND DIAGNOSTIC parameters conform to the page structure as specified in SCSI-2.

SelfTest - Byte 01, Bit 2

This field indicates whether the library should perform the diagnostic test specified in the parameter list or a standard self-test, as follows:

0 – Perform the diagnostic test specified in the parameter list (see "SelfTest Bit is 0").

1 – Perform the standard self-test (see "SelfTest Bit is 1").

SelfTest Bit is 0 When the SelfTest bit is set to 0, the library performs the diagnostic operation that you have specified in the parameter list.

If the operation is successful, the library returns Good status to the SEND DIAGNOSTIC command, and you can use a RECEIVE DIAGNOSTIC RESULTS command to obtain the results of the following:

- Tape drive calibration procedure
- Cartridge sensor calibration procedure
- Eject position calibration procedure

Notes:

■ The EXB-10h does not perform tape drive calibration. If requested to do so, the EXB-10h returns Good status in response to the SEND DIAGNOSTIC command and returns valid data in response to the RECEIVE DIAGNOSTIC RESULTS command.

■ If you request a redefinition of zero on the vertical and horizontal axes or a verification of the pick-and-place functionality, the library does not generate a Receive Diagnostic Results page.

If the operation was not successful, the library returns Check Condition status. The sense key is set to Hardware Error and the ASC and ASCQ will identify what kind of hardware error occurred. The library will not execute any further motion commands. A subsequent RECEIVE DIAGNOSTIC RESULTS command will contain no valid information.

SelfTest Bit is 1 When the SelfTest bit is set to 1, the library completes its default self-test, which includes the following:

- Redefine zero on the horizontal and vertical axes

- Verify the functionality of the library pick-and-place procedures

If the self-test passes successfully, the library terminates the SEND DIAGNOSTIC command with Good status. Otherwise, the library terminates the command with Check Condition status and sets the sense key to Hardware Error (4h). The ASC and ASCQ indicate what kind of hardware error occurred.

Note: When you set the SelfTest bit to 1, you must specify a parameter list length of 0.

DevOfl (Device Offline) - Byte 01, Bit 1

Since diagnostic tests must be performed with the library online, the valid value for this field is 0.

UnitOfl - Byte 01, Bit 0

Since the library is a single logical unit, the valid value for this field is 0.

Parameter List Length - Bytes 03 and 04

This field can contain one of two values, as described below:

0 – No data will be transferred. Good status is returned.

4 – Specifies the length in bytes of the parameter list that you will transfer to the library.

> **Note:** This field must be 0 if the SelfTest bit is 0.

If the specified parameter list length results in the truncation of a page and the PF bit is set to 1, the library returns Check Condition status with the sense key set to Illegal Request and an ASC of Invalid Field in CDB.

SEND DIAGNOSTIC Parameter List

To request that the library perform a diagnostic test other than its default self-test, set the SelfTest bit in the CDB to 0 and use the parameter list to specify the test.

This section describes the format of the parameter list and the types of tests you can request. You can request one test per SEND DIAGNOSTIC command.

The format of the 4-byte parameter list is as follows:

Bit Byte	7	6	5	4	3	2	1	0
00	Page Code							
01	Reserved							
02	Page Length = 0							
03								

Page Code - Byte 0

The Page Code field specifies the diagnostic test the library should perform. The library supports the page codes shown in Table 16-1.

Table 16-1 Diagnostic tests

Page Code	Description
00h	Returns a list of all diagnostic page codes the library implements.
80h	Performs a tape drive calibration.*
81h	Performs a cartridge sensor calibration.
82h	Performs an eject position calibration.
83h	Instructs the library to perform a verification of its pick-and-place functionality. To do this, the library performs the following actions for each cartridge in the cartridge magazine, starting with slot 1 (the bottommost slot): 1. Picks the cartridge from the slot 2. Places the cartridge in the tape drive 3. Moves to the park position at the base of the library 4. Picks the cartridge from the tape drive 5. Places the cartridge back into its original slot If a slot does not contain a cartridge, the CHM moves to the next slot. After the library has processed all slots, it returns status to the host. If the CHM or any of the slots in the cartridge magazine are reserved, the library returns a Reservation Conflict status.
84h	Instructs the library to perform a redefinition of zero on the vertical and horizontal axes (in other words, it redefines the vertical and horizontal axis zero position). The horizontal axis zero position is the farthest position away from the cartridge magazine. The vertical axis zero position is at the top of the vertical lead screw.

*The EXB-10h does not perform tape drive calibration. If requested to do so, the EXB-10h returns Good status but performs no action.

Page Length - Bytes 02 and 03

The value for this field must be 0.

16.3 How the Library Executes This Command

The steps described in this section occur after the library has been selected and has successfully received the CDB, and there are no conditions present that prevent the command from being executed.

Figure 16-1 shows the steps that the library takes when executing the command through the bus free phase. As shown in the figure, the library validates the parameters in both the CDB and the vendor specific data. Table 16-2 shows the sense data reported for invalid parameters in the CDB and in the vendor specific page of this command.

> **Note:** This section describes the normal processing of the command through the bus free phase. Additional processing may occur if the message system is enabled and the library responds to attention by going to the message out phase or if parity errors are detected in the vendor data.

Begin
SEND DIAGNOSTIC (1Dh) command execution

Is the Self Test bit set in the CDB?

Are the parameters in the CDB valid?

No → Set Check Condition status and set sense data to indicate first invalid parameter detected

Is the grab base empty?

No → Set Check Condition status and set sense data to indicate a data cartridge in the grab base

Data Out phase: receive the Send Diagnostic Parameter List

Has a Check Condition occurred?

Are the parameters in the Send Diagnostic Parameter List valid?

No → Set Check Condition status and set sense data to indicate the first invalid parameter detected in the Send Diagnostic Parameter List

Has tape drive calibration, eject position calibration, or pick-and-place been selected and is the grab base empty?

No → Set Check Condition status and set sense data to indicate the grab base is full

EXB-10h: Has pick-and-place been selected and is the tape drive empty?

EXB-10e: Has pick-and-place been selected and is the tape drive's door open?

No → Set Check Condition status and set sense data to indicate that the tape drive is full (EXB-10h) or the tape drive's door is closed (EXB-10e)

Disconnect from SCSI bus, if allowed

Perform diagnostic test Update cartridge inventory and status

Is the library disconnected from the SCSI bus?

Yes → Reconnect to the initiator

Send Status In, Command Complete Message In, and disconnect from the SCSI bus

END
Bus free phase

Figure 16-1 SEND DIAGNOSTIC command execution

16.4 Command Status

The library returns a status byte after processing the SEND DIAGNOSTIC command.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 15 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the library is processing the command.

- The library detects an unrecoverable parity error while receiving the CDB or the vendor unique page.

- The command is issued to an invalid LUN.

- A Unit Attention condition is pending for the initiator.

- The library has experienced an unrecoverable hardware error.

- The library is not ready because the door is open, or it is operating in sequential mode, LCD mode, or CHS Monitor mode.

- A reserved bit is set to 1 in the CDB.

- A parameter in the CDB or Send Diagnostic Parameter List is invalid (see Table 16-2 for sense data).

- The library encounters a hardware problem while trying to perform the requested test.

Table 16-2 Invalid parameters in the SEND DIAGNOSTIC CDB

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
4h	40h	80h	0	0	0	0	0000h	The cartridge magazine was empty or the cartridge sensor is malfunctioning.
5h	24h	0h	1	1	1	4h	0001h	The PF bit is not set.
5h	24h	0h	1	1	0	0	0003h	Invalid parameter list length. The parameter list length must be 4 or 0.
5h	26h	0h	1	0	0	0	0000h	Invalid page code in parameter list.
5h	26h	0h	1	0	1	–	0001h	Reserve bit set in byte 1 or parameter list bit pointer points to a bit in error.
5h	26h	0h	1	0	0	0	0002h	Invalid page length.
5h	40h	81h	0	0	0	0	0000h	A cartridge is in the grab base.
5h	40h	82h	0	0	0	0	0000h	EXB-10h: The tape drive contains a cartridge EXB-10e: The tape drive's door is closed.
5h	1Ah	0	0	0	0	0	0000h	The list length in the CDB does not match the page code in the parameter list.

Notes:

17 TEST UNIT READY (00h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	0
01	Logical Unit Number			Reserved				
02	Reserved							
03								
04								
05	0	0	Reserved				0	0

17.1 About This Command

The TEST UNIT READY command allows the initiator to determine if the library is ready to accept all other commands, including motion commands. This is not a request for an library self-test, which occurs at power-on. If the library is ready to accept any command without returning Check Condition, Reservation Conflict, or Busy status, this command returns Good status.

Note: The library does not check to see if a different initiator has any elements reserved. If an element is reserved by a different initiator, the library returns Reservation Conflict status for the next requested command after the TEST UNIT READY command.

17.2 How the Library Executes This Command

The library returns Good status for the TEST UNIT READY command if it is able to process the command without errors. After the library determines the status to return, it does the following:

1. The library goes to the status in phase and returns either Good, Check Condition, Busy, or Reservation Conflict status to the initiator (see Section 17.3).

2. After the initiator has accepted the status byte, the library goes to the message in phase, sends the Command Complete message to the initiator, and then goes to the bus free phase.

17.3 Command Status

The library returns a status byte after processing the TEST UNIT READY command.

Good

The library returns Good status when it is able to process the command without errors.

Busy

The library returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The library returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 15 for more information about the RESERVE (16h) command.

Check Condition

The library returns Check Condition status for the following reasons:

■ The message system is enabled and a message error occurs while the library is processing the command.

■ The library detects an unrecoverable parity error while receiving the CDB.

- The command is issued to an invalid LUN.

- A Unit Attention condition is pending for the initiator.

- The library has experienced an unrecoverable hardware error.

- The library is not ready because the door is open, or it is operating in sequential mode, LCD mode, or CHS Monitor mode.

- A reserved bit is set to 1 in the CDB.

Notes:

A Library Error Handling

This appendix describes error handling by the library and appropriate initiator responses when error conditions are detected during different SCSI bus phases. The errors and responses are separated into two categories:

- Errors and responses related to initiators that support only the Command Complete message

- Errors and responses related to initiators that support messages in addition to the Command Complete message

Initiators That Support Only the Command Complete Message

This section describes library error handling and appropriate initiator responses during different bus phases for initiators that support only the Command Complete message.

Error Handling During the Command Out Phase

Figure A-1 on page A-3 shows the action that the library takes during the Command Out phase, when the message system is not enabled. Specifically, Figure A-1 defines the action the library takes when:

- The library detects a parity error in the CDB (the library can detect parity errors only when parity checking is enabled).

- The first CDB byte does not have a valid Group Code and the Operation (OP) Code is not a vendor unique library command.

The Group Code is the upper three bits of the first CDB byte, and the OP Code is the lower five bits of the first CDB byte. The library uses the Group Code to determine the total number of bytes in the CDB. The Group Code specifies one of the following groups:

Group 0 - Six-byte commands
Group 1 - Ten-byte commands
Group 2 - Ten-byte commands
Group 3 - Reserved
Group 4 - Reserved
Group 5 - Twelve-byte commands
Group 6 - Vendor specific
Group 7 - Vendor specific

- The Group Code is valid but the OP Code is not supported by the library. The library attempts to read the entire CDB even if the OP Code is not supported.

- The library detects an invalid initiator reselection. Refer to page 3-8 for more information about an invalid initiator reselection.
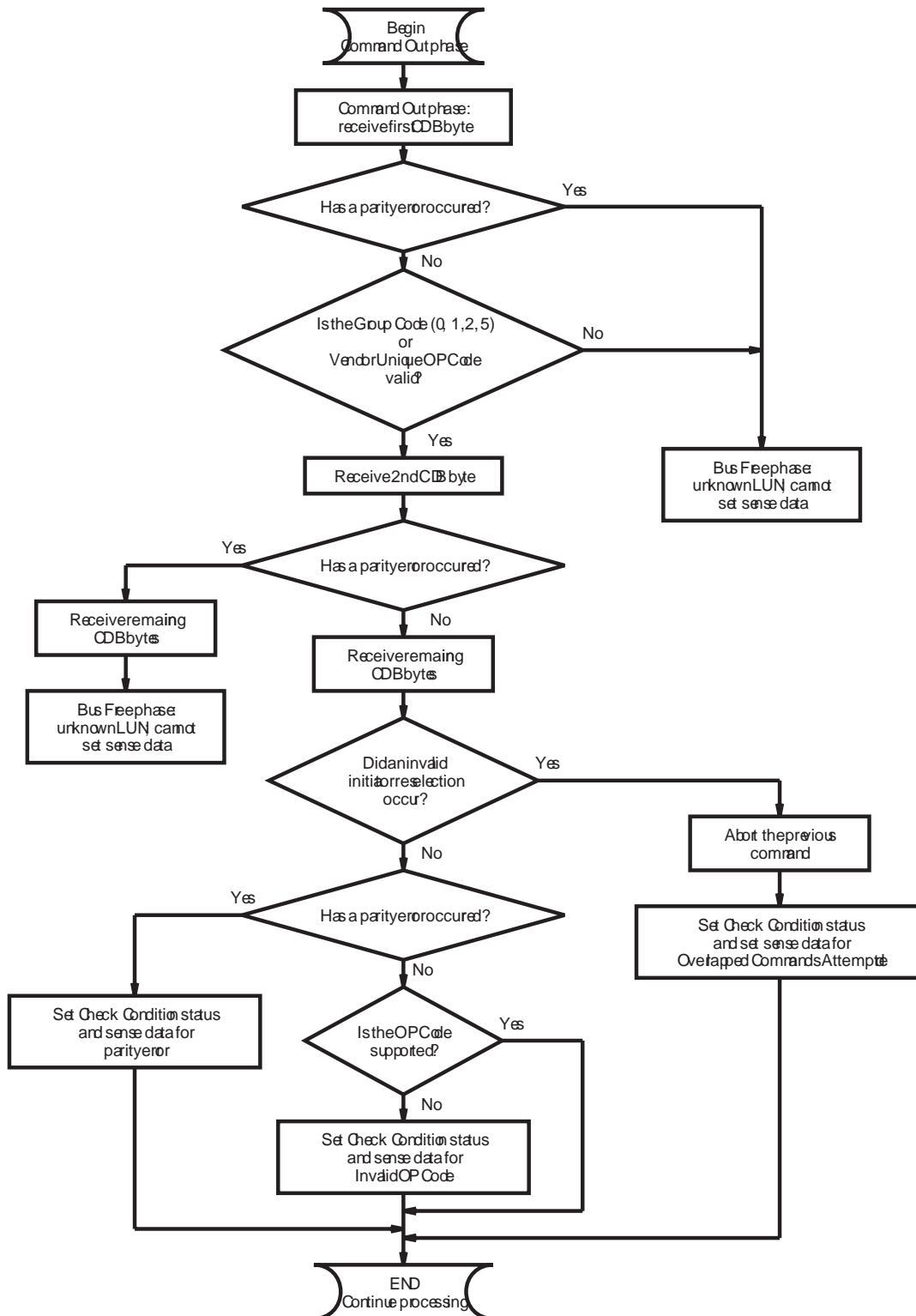
Figure A-1 Error handling during the Command Out phase (for systems that support only the Command Complete message)

Error Handling During the Data Out Phase

When parity checking is enabled, the library checks the parity of the data received during the Data Out phase. Figure A-2 describes the action that the library takes if it detects a parity error during the Data Out phase.

Note: The library can transfer 2,048 bytes at a time. If the Transfer Length specified for a particular command is greater than 2,048 bytes, the library executes the steps shown in Figure A-2 repeatedly, transferring the data in 2,048-byte increments until all bytes are transferred.
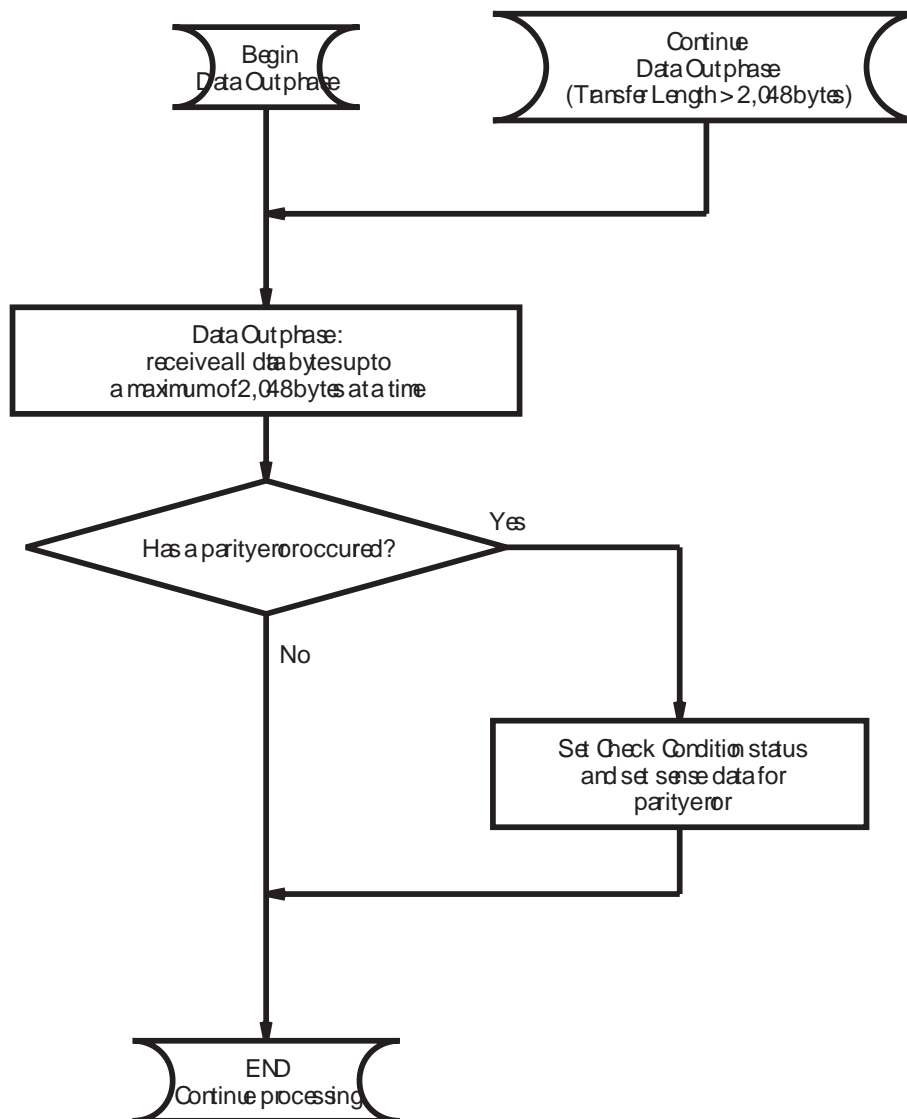
Figure A-2 Error handling during the Data Out phase (for systems that support only the Command Complete message)

Error Handling During the Data In Phase

When an initiator detects a parity error during the Data In phase, it must accept all bytes sent by the library. Unless the command was a REQUEST SENSE command, the initiator should attempt to resend the command to receive the requested data again.

If the initiator detects a parity error while receiving the data for the REQUEST SENSE command, the sense data is not recoverable.

The library preserves sense data for the initiator only until the initiator retrieves the data using the REQUEST SENSE command or until the library receives any subsequent command for the same I_T_L nexus (initiator-target-LUN connection).

Error Handling During the Status In Phase

When the initiator detects a parity error in the Status In phase, the initiator should assume that the library was returning Check Condition status. The initiator should then issue a REQUEST SENSE command and decode the sense bytes. (Even if the status byte that had the parity error was Good, Busy, or Reservation Conflict, decoding the sense data has no harmful effects on operation.)

Note: The library processes the REQUEST SENSE command even when it is busy or reserved by another initiator.

Initiators That Support Additional Messages

This section describes library error handling and appropriate initiator responses during different bus phases for initiators that support messages in addition to the Command Complete message.

Error Handling During the Message Out Phase

Figure A-3 shows the actions that the library takes during the Message Out phase. When parity checking is enabled and the library detects one or more parity errors in the message bytes it receives during a single Message Out phase, the following actions occur:

1. The library indicates its desire to retry the message by asserting the Request (REQ) signal after detecting the Attention signal has gone false and before changing to any other phase.

2. Upon detecting this condition, the initiator should resend all of the previous message bytes in the same order as previously sent during this phase.

   Note: When resending more than one message byte, the initiator should assert the Attention signal at least two deskew delays before asserting the Acknowledge signal on the first byte and should maintain the Attention signal until the last byte is sent.

3. The library acts on the messages as long as it does not detect any parity errors. However, if it detects a parity error, the library ignores all remaining messages sent under one Attention condition.

4. The library continues to retry the Message Out phase until it does not detect any parity errors or until the initiator aborts the current command or resets the library.
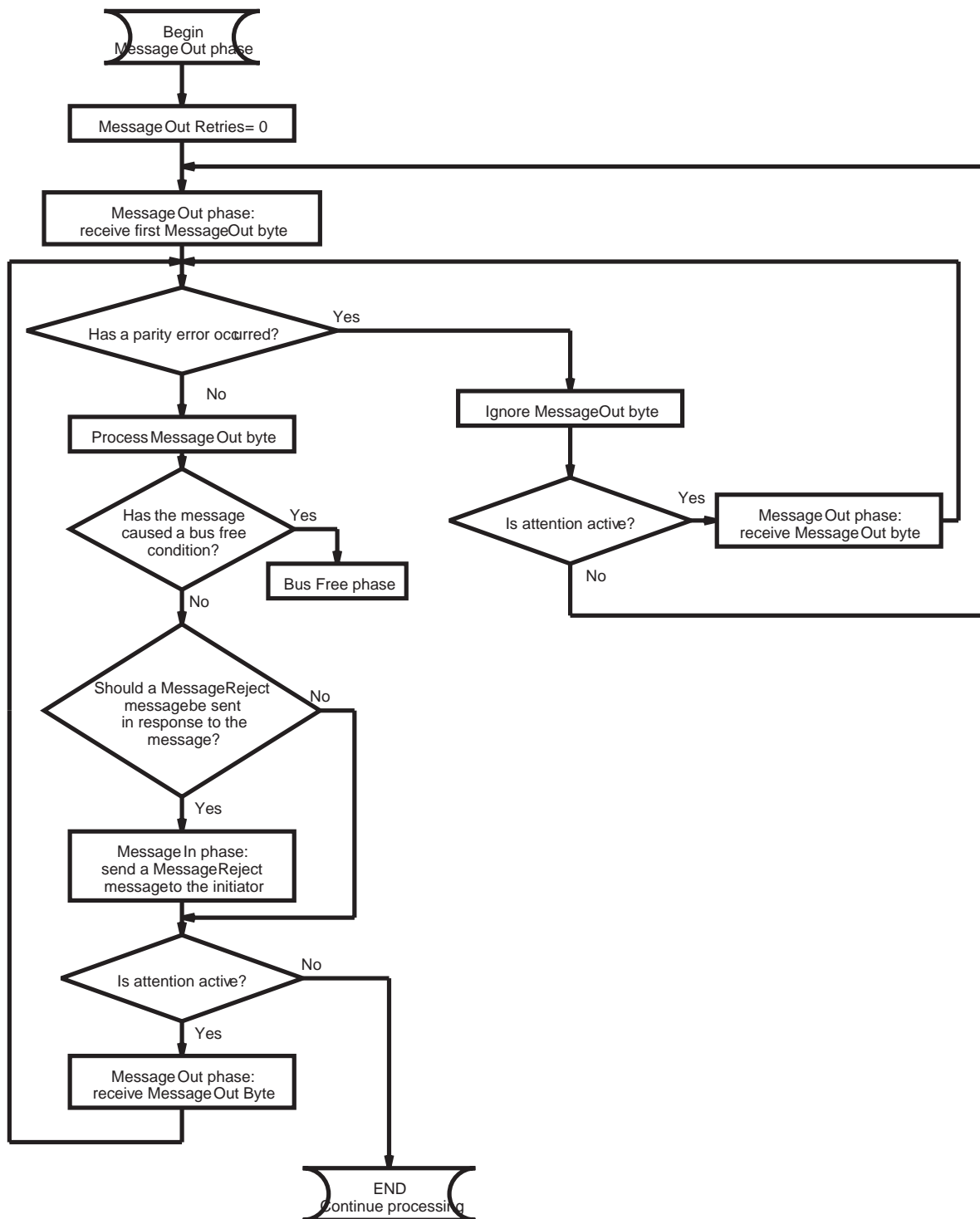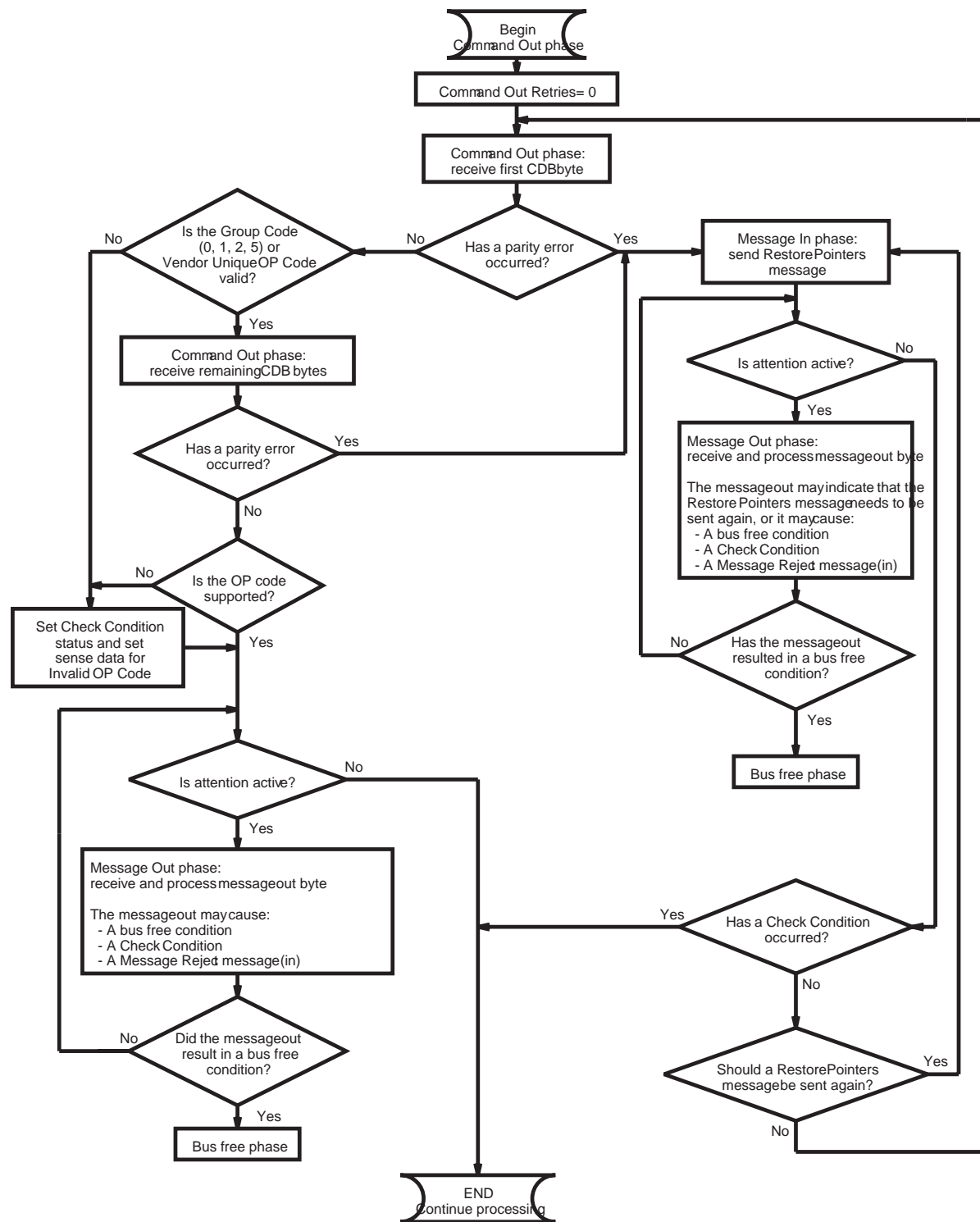
Figure A-3 Error handling during the Message Out phase (for systems that support additional messages)

Error Handling During the Message In Phase

If the initiator detects a parity error during the Message In phase, the initiator should respond by sending a Message Parity Error (09h) message to the library. Upon receiving the Message Parity Error message, the library resends the message. The library will resend the message as many times as requested by the initiator.

Error Handling During the Command Out Phase

Figure A-4 shows the action taken by the library during the Command Out phase, when the message system is enabled. Specifically, Figure A-4 defines the action the library takes when:

- The library detects a parity error in the CDB (parity errors are only detected when parity checking is enabled).

- A Check Condition occurs while the library tries to send the Restore Data Pointers message after detecting a parity error.

- The first CDB byte does not have a valid Group Code and the OP Code is not a vendor unique library command.

  The Group Code is the upper three bits of the first CDB byte, and the OP Code is the lower five bits of the first CDB byte. The library uses the Group Code to determine the total number of bytes in the CDB. The Group Code specifies one of the following groups:

    Group 0 - Six-byte commands
    Group 1 - Ten-byte commands
    Group 2 - Ten-byte commands
    Group 3 - Reserved
    Group 4 - Reserved
    Group 5 - Twelve-byte commands
    Group 6 - Vendor specific
    Group 7 - Vendor specific

- The Group Code is valid but the OP Code is not supported by the library. The library attempts to read the entire CDB even if the OP Code is not supported.

Figure A-4 Error handling during the Command Out phase (for systems that support additional messages)

Error Handling During the Data Out Phase

Figure A-5 shows the action the library takes during the Data Out phase when the message system is enabled. Specifically, Figure A-5 defines the action the library takes when:

- The library detects parity errors in the data (parity errors are only detected when parity checking is enabled).

- A Check Condition occurs while the library attempts to send the Restore Data Pointers message after detecting a parity error.

Figure A-5 also shows when the library responds to the Attention signal with a Message Out phase.

> **Note:**   The library can transfer 2,048 bytes at a time. If the Transfer Length specified for a particular command is greater than 2,048 bytes, the library executes the steps shown in Figure A-5 repeatedly, transferring the data in 2,048-byte increments until all bytes are transferred.
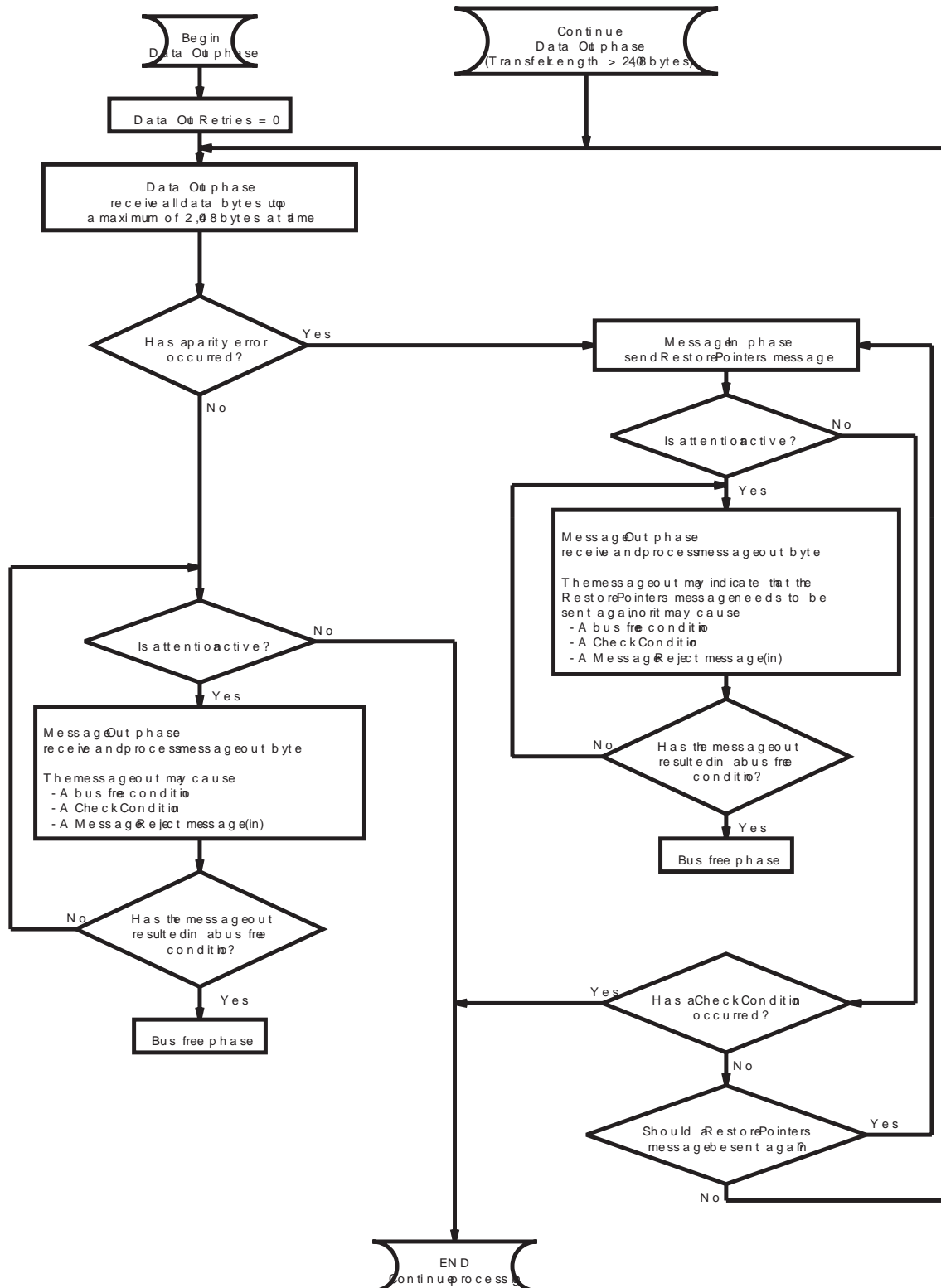
Figure A-5 Error handling during the Data Out phase (for systems that support additional messages)

Notes:

B Library Message Processing

This appendix includes information about the following:

- The library's response to the Attention signal during different SCSI bus phases

- The messages supported by the library

- The library's response to messages from the initiator during different SCSI bus phases

When the Library Accepts and Processes Messages

Once the initiator sends a valid Identify message during the Selection phase, the message system has been established and the library accepts and processes messages from the initiator whenever the initiator asserts the Attention signal.

Table B-1 shows when the library responds to the Attention signal for each SCSI bus phase.

Table B-1 When the library responds to the Attention signal

If the initiator asserts the Attention signal during this phase...	The library responds...
Selection	Immediately following the selection.
Command	At the end of the Command phase, after all CDB bytes have been received.
Data In	After all bytes have been sent to the initiator.
Data Out	After all bytes from the initiator have been received.
Status In	After the status byte has been sent to the initiator.
Message In	After the message has been sent to the initiator.

SCSI Messages Supported by the Library

As described in Chapter 1, the message system allows communication between an initiator and the library for physical path management. These messages allow the initiator and the library to manage error detection, data transfer retries, and the data path.

The library supports messages that are one byte in length only. One or more messages can be sent during a single message phase.

The library supports the SCSI messages listed in Table B-2.

Table B-2 Messages supported by the library

		Direction	
Hex Value	**Message**	**In (Library to Initiator)**	**Out (Initiator to Library)**
00h	Command Complete	✔	
03h	Restore Pointers	✔	
04h	Disconnect	✔	
05h	Initiator Detected Error		✔
06h	Abort		✔
07h	Message Reject	✔	✔
08h	No Operation		✔
09h	Message Parity Error		✔
0Ch	Bus Device Reset		✔
80h or C0h	Identify	✔	✔

This section describes each of these messages in more detail. The messages are described in hex code order.

Command Complete Message In (00h)

The library sends the Command Complete message to the initiator to indicate that the execution of the command has completed and that valid status has been sent to the initiator. After the library successfully sends this message, the bus goes to the Bus Free phase.

Restore Pointers Message In (03h)

The library sends the Restore Pointers message in either of the following cases:

- The library did not properly receive a block of data. The Restore Pointers message instructs the initiator to send the data again. The initiator should copy the most recently saved command, data, and status pointers for the I/O process to the corresponding active pointers. The pointers are restored as follows:

  - **Command and status pointers** are restored to the beginning of the present command and status areas.

  - **The data pointer** is restored to the value at the beginning of the data area.

- The library received an Initiator Detected Error message following either the Status phase or Data In phase or detected a parity error during the Command phase or Data Out phase. After the library successfully sends the Restore Pointers message to the initiator, the library restarts the Command, Data In, Data Out, or Status phase from the beginning.

Disconnect Message In (04h)

The library sends the Disconnect message to the initiator when it is about to break the present physical path. The library disconnects by releasing the BSY signal.

This message does not cause the initiator to save the data pointer.

Note: If a catastrophic error condition has occurred during the current command, the library does not send the Disconnect message or the Command Complete message, but instead goes immediately to the Bus Free phase.

Initiator Detected Error Out (05h)

The initiator sends the Initiator Detected Error message to inform the library that an error has occurred that does not preclude the library from retrying that operation. The source of the error may either be related to previous activities on the SCSI bus or may be internal to the initiator and unrelated to any previous SCSI bus activities.

> **Note:** Refer to Table B-3 for information about how the library handles the Initiator Detected Error message during different bus phases.

Abort Message Out (06h)

The initiator sends the Abort message to the library to clear a previously requested process for the I_T_L nexus (initiator-target-LUN connection). The library goes to the Bus Free phase immediately after it receives the Abort message. Additional action depends on the LUN, if established, as described below:

- If the library receives the Abort message after the Identify message, an I_T_L nexus is established. If the LUN is valid, all pending data and status for the issuing initiator is cleared and any previously requested process by that initiator is aborted. If the LUN is invalid, no additional action is taken.

- If the library receives the Abort message before the Identify message, only an I_T nexus is established. The library goes bus free, but no pending I/O processes will abort.

Any pending data, status, and command processing for any other initiator is unaffected by this message. For example, if the library is disconnected while processing a command for a different initiator, the processing of that command is unaffected by the Abort message.

The library aborts motion commands as soon as reasonably possible.

> **Note:** Refer to Table B-4 for information about how the library checks for the Abort message and when it aborts the indicated motion command after receiving the Abort message.

Message Reject Message In/Out (07h)

The Message Reject message is sent by either the initiator or the library to indicate that the last message it received was inappropriate or not supported.

> **Note:** Refer to Table B-5 for information about how the library handles the Message Reject message during different bus phases.

No Operation Out (08h)

The initiator sends the No Operation message in response to the library's request for a message when the initiator does not currently have a valid message to send.

The library does not take any action in response to the No Operation message; it accepts this message and continues processing the current command.

Message Parity Error Out (09h)

The initiator sends the Message Parity Error message to the library to indicate that the last message byte it received had a parity error.

> **Note:** Refer to Table B-6 for information about how the library handles the Message Parity Error message during different bus phases.

Bus Device Reset Message Out (0Ch)

The initiator sends the Bus Device Reset message to direct the library to clear all I/O processes. This message forces a soft reset condition for the library.

The library goes immediately to the Bus Free phase once it successfully receives this message. As with a SCSI bus reset or power-on reset, the library sets a sense key of Unit Attention (6h) for all initiators.

Identify Message In/Out (80h or C0h)

The Identify message is sent by either the initiator or the library to establish an I_T_L nexus (initiator-target-logical unit number connection) and to enable the message system.

The initiator can send one or more Identify messages during a connection. The initiator sends more than one Identify message during a connection to change the disconnect privilege. When the library processes commands that require a lengthy amount of time, it disconnects and reconnects only once. Therefore, it is only relevant for the initiator to change the disconnect privilege before the Status In phase (for example: during the first Message Out phase, after the Command phase, or after a Disconnect message in).

The initiator may not send additional Identify messages to the library with a different LUN specified.

Note: For more information about how the library responds to the Identify message during different SCSI bus phases, refer to Tables B-7 through B-10.

Bit Byte	7	6	5	4	3	2	1	0
00	Identify	DiscPriv	LUNTAR	Reserved		LUN		

Bit 7 - Identify

This bit must be set to 1 to indicate this is the Identify message.

Bit 6 - DiscPriv (Disconnect Privilege)

This bit indicates whether the initiator supports the disconnect privilege, as follows:

0 – Disconnect is not allowed.
1 – Disconnect is allowed.

The library always sets this bit to 0. Only initiators indicate if they support disconnect.

Bit 5 - LUNTAR (Logical Unit Target)

This bit indicates the LUNs that you can access on this device. This bit must be 0 to indicate that the Identify message is directed to a logical unit.

Bits 2 through 0 - LUN (Logical Unit Number)

The only supported logical unit number (LUN) for the library is 0.

Notes:

- If the LUN field is set to a value other than 0, the library returns Check Condition status to commands other than INQUIRY and REQUEST SENSE, and the sense data is set to indicate that the logical unit is not supported.

- If an INQUIRY command is directed to a LUN other than 0, the first byte of inquiry data indicates that the library is not capable of supporting a physical device on the requested LUN.

- If a REQUEST SENSE command is directed to a LUN other than 0, the sense data returned indicates that the logical unit is not supported.

How the Library Responds to Messages

The following sections explain the action that the library takes in response to each message it receives from the initiator. The tables in this section show the following:

- The bus phase that was active just before the library received the indicated message

- The action that the library takes in response to the indicated message

It is possible for the library to return Check Condition status in response to a message error. The library sends a Message Reject message instead of Check Condition status if the requested command has already been completed. A command is considered complete once the library has sent or has attempted to send ending status.

Note: For more information about command status, see Chapter 1.

Response to Unsupported Messages Out

When the library receives messages that are not supported, it sends a Message Reject message after the first invalid message byte and then continues processing the current command.

Response to Initiator Detected Error Message

Table B-3 shows how the library handles the Initiator Detected Error message during different bus phases.

Table B-3 Handling of Initiator Detected Error message

If the library receives an Initiator Detected Error message during this bus phase...	The library does this...
Command Data out	Returns Check Condition status and sets sense data as follows: 　　Sense Key = Aborted Command (Bh) 　　ASC = Initiator Detected Error (48h) 　　ASCQ = 0
Data in Status	■ Sends a Restore Pointers message. ■ Resends the data or status.
Message out	If the library has completed the command and attempted to return status: ■ Sends a Message Reject message. ■ Does not set sense data since the command was already processed. Otherwise, returns Check Condition status and sets sense data as follows: 　　Sense Key = Aborted Command (Bh) 　　ASC = Initiator Detected Error (48h) 　　ASCQ = 0
Message in 　　Msg Reject	Sends another Message Reject message.
Message in 　　Cmd Complete 　　Disconnect 　　Restore Ptrs 　　Identify	■ Sends a Message Reject message. ■ Resends the last message in.

Response to Abort Message

Table B-4 describes when the library checks for the Abort message and when it aborts the indicated motion command after receiving the Abort message.

Note: Until it completely aborts a motion command, the library terminates all commands other than INQUIRY (12h) or REQUEST SENSE (03h) with Busy status.

Table B-4 When the library aborts motion commands

When processing this command...	The library checks for the Abort message...	...and aborts the command at this time...
INITIALIZE ELEMENT STATUS	Before checking each element.	■ Before checking the next element. ■ If checking an element, after it checks that element.

When processing this command...	The library checks for the Abort message...	...and aborts the command at this time...
MOVE MEDIUM	■ Before picking the cartridge. ■ Before placing the cartridge. ■ EXB-10h: If the destination is the tape drive, before pushing the cartridge completely into the tape drive. ■ EXB-10e: If the destination is the tape drive, before closing the door.	■ If the Abort message is received before the pick operation is started, the library does not perform the pick operation. ■ If the Abort message is received after the pick operation but before the place operation, the library returns the cartridge to its initial location. ■ If the Abort message is received after the cartridge has been placed into its destination and the destination is not a tape drive, the library does not return the cartridge to its initial location. ■ If the Abort message is received after the cartridge has been placed into the tape drive but before the tape drive's door has been closed (EXB-10e) or before the cartridge has been completely inserted (EXB-10h), the library returns the cartridge to its initial location. ■ If the Abort message is received after a cartridge has been placed in the tape drive and the tape drive's door has been closed (EXB-10e) or the cartridge has been completely inserted (EXB-10h), the cartridge cannot be moved back to its original location.
POSITION TO ELEMENT	Before positioning the CHM.	■ If the library receives an Abort message after it has begun to move the CHM, it completes the operation and does not return the CHM to its original position.

When processing this command...	The library checks for the Abort message...	...and aborts the command at this time...
SEND DIAGNOSTICS: Test 80h, tape drive Calibration	■ Before beginning calibration. ■ Before each pick operation during calibration. ■ Before each place operation during calibration.	■ If the library receives an Abort message before calibration starts, it does not perform calibration. ■ If the library receives an Abort message before it starts a pick operation from either the cartridge magazine or the tape drive, it does not finish the calibration. ■ If the library receives an Abort message after it picked a cartridge from the cartridge magazine, it returns the cartridge to its initial location and stops the calibration. ■ If the library receives an Abort message after it picked a cartridge from the tape drive, it returns the cartridge and stops the calibration. ■ If the library receives an Abort message after it placed the cartridge into its destination, it stops the calibration and does not return the cartridge to its original position.
Test 81h, Cart. Sensor Calibration **and** Test 82h, Eject Position Calibration	Before positioning in front of slot 1 of the cartridge magazine.	■ If the library receives an Abort message before it starts the positioning operation, it does not perform the calibration. ■ If the library receives an Abort message after it starts the positioning operation, it completes the calibration.
Test 83h, Pick/Place Functionality	■ Before each pick operation ■ Before each place operation	■ If the library receives an Abort message before it picks a cartridge from either the cartridge magazine or the tape drive, it stops the pick/place test. ■ If the library receives an Abort message after it picks a cartridge from either the cartridge magazine or tape drive, it returns the cartridge to its original location and stops the pick/place test.

When processing this command...	The library checks for the Abort message...	...and aborts the command at this time...
Test 84h, Redefine 0 on X and Z axes	Before the library starts the Home Z operation.	■ If the library receives an Abort message before it starts the Home Z operation, it does not perform the Home Z and Home Y operations. ■ If the library receives an Abort message after it starts the Home Z operation, it performs both the Home Z and Home Y operations.
Self Test	■ Before the Home Z operation is started. ■ Before each pick operation. ■ Before each place operation.	■ If the library receives an Abort message before it starts the Home Z operation, the library stops the self test immediately. ■ If the library receives an Abort message after the it starts the Home Z operation, it performs both the Home Z and Home Y operations and stops the Self Test. ■ If the library receives an Abort message before it picks a cartridge from either the cartridge magazine or the tape drive, the library stops the self test immediately. ■ If the library receives an Abort message after it has picked a cartridge from either the cartridge magazine or the tape drive, it returns the cartridge to its initial location and then stops the self test.

Library Response to Message Reject Message

Table B-5 shows how the library handles the Message Reject message during different bus phases.

Table B-5 How the library handles a Message Reject message

If the library receives a Message Reject during this bus phase...	The library does this...
Command	Sends a Message Reject message.
Data out	
Data in	
Status	
Message out	
Message in Cmd Complete	Goes to the Bus Free phase.
Message in Disconnect	Does not disconnect; continues processing the command.

Message in
    Restore Ptrs
	If sent after Status phase:
	■ Sends a Message Reject message.
	■ Does not change sense data since the command is complete.
	■ Continues to the Command Complete message.
	
	If sent after the Command phase or Data Out phase:
	    Returns Check Condition status and sets sense data as follows:
	        Sense Key = Aborted Command (Bh)
	        ASC = SCSI Parity Error (47h)
	        ASCQ = 0
	
	If sent after Data In phase:
	    Returns Check Condition status and sets sense data as follows:
	        Sense Key = Aborted Command
	        ASC = Initiator Detected Error Message Received (48h)
	        ASCQ = 0

Message in Msg Reject	Sends a Message Reject message.

Message in
    Identify
	Goes bus free immediately and sets sense data as follows:
	        Sense Key = Aborted Command (Bh)
	        ASC = Reselect Failure (45h)
	        ASCQ = 0

Library Response to Message Parity Error Message

Table B-6 shows how the library handles the Message Parity Error message during different bus phases.

Table B-6 Handling of Message Parity Error message

If the library receives a Message Parity Error message during this bus phase...	The library does this...

Command	Goes bus free immediately and sets sense data as follows:
	    Sense Key = Aborted Command (Bh)
	    ASC = Message Error (43h)
	    ASCQ = 0

Data out	
Data in	
Message out	
Status	

Message in
    Cmd Complete
    Disconnect
    Msg Reject
    Restore Ptrs
    Identify
	Sends the last message again.

Library Response to Identify Message Out

Tables B-7 through B-10 show how the library handles the Identify message from the initiator during different bus phases. The tables include information about how the library responds to the following:

- A valid first Identify message

- A subsequent Identify message with the same LUN as the first message

- A subsequent Identify message with a different LUN

- An Identify message with reserved bits 3, 4, or 5 set

Table B-7 Library action when the first Identify message is valid

If the library receives a valid Identity message during this bus phase...	The library does this...
Select	■ Processes messages. ■ Sets disconnect privilege to the value of DiscPriv (bit 6) of the Identify message out. ■ Sets the LUN field to the LUN specified in the Identify message out.

Table B-8 Handling of valid Identify message with the same LUN as for the first Identify message

If the library receives an Identify message during this bus phase...	The library does this...
Select	■ Sets disconnect privilege to the value of DiscPriv (bit 6) of the Identify message out.
Command	
Data out	■ Continues processing the command as before.
Data in	
Status	
Message out	
Message in Cmd Complete	Goes bus free.
Message in Disconnect	■ Sets disconnect privilege to the value of DiscPriv (bit 6) of the Identify message out. ■ If DiscPriv is 0, the library does not disconnect and continues processing as before. ■ Otherwise, goes bus free.
Message in Msg Reject Restore Ptrs Identify	■ Sets disconnect privilege to the value of DiscPriv (bit 6) of the Identify message out. ■ Continues processing the command as before.

Table B-9 Handling of invalid Identify message with different LUN

If the library receives an Identify message during this bus phase...	The library does this...

Command	Goes bus free immediately and sets sense data as follows:
	    Sense Key = Aborted Command (Bh)
	    ASC = Message Error (43h)
	    ASCQ = 0

Data out	
Data in	
Status	
Message out	

Message in
    Cmd Complete
    Disconnect
    Msg Reject
    Restore Ptrs
    Identify	

Table B-10 Handling of invalid Identify message with reserved bits 3, 4, or 5 set

If the library receives an Identify message during this bus phase...	The library does this...

Select	■ Returns Check Condition status and sets sense data as follows:
	    Sense Key = Illegal Request (5h)
	    ASC = Invalid Bits in Identify message (3Dh)
	    ASCQ = 0
	
	■ Skips the Command phase and goes directly to the Status phase.

Command	■ Returns Check Condition status and sets sense data as follows:
	    Sense Key = Illegal Request (5h)
	    ASC = Invalid Bits in Identify message (3Dh)
	    ASCQ = 0
	
	■ Skips any data phase and goes directly to the Status phase.

Data out	
Data in	
Status	■ Sends a Message Reject message. ■ Does not set sense data since the command is complete. ■ Continues to the Message In phase to send the Command Complete message.

If the library receives an Identify message during this bus phase...	The library does this...

Message out	If the command is complete and the library has attempted to return status:
	■ Sends a Message Reject message.
	■ Does not set sense data, since the command is complete.
	
	Otherwise, returns set Check Condition status and sets sense data as follows:
	    Sense Key = Illegal Request (5h)
	    ASC = Invalid Bits in the Identify message (3Dh)
	    ASCQ = 0

Message in Cmd Complete	■ Sends a Message Reject message. ■ Does not set illegal sense data since the command was already processed. ■ Goes to the Bus Free phase.

Message in
    Disconnect
	■ Does not disconnect.
	
	■ Aborts the current operation.
	
	■ Returns Check Condition status and sets sense data as follows:
	    Sense Key = Illegal Request (5h)
	    ASC = Invalid Bits in the Identify message (3Dh)
	    ASCQ = 0
	
	■ Goes directly to the Status phase.

Message in
    Restore Ptrs
    Msg Reject
    Identify
	If the command is complete and the library has attempted to return status:
	■ Sends a Message Reject message.
	
	■ Does not set sense data since the command was already processed.
	
	Otherwise, returns Check Condition status and sets sense data as follows:
	    Sense Key = Illegal Request
	    ASC = Invalid Bits in the Identify message (3Dh)
	    ASCQ = 0

Notes:

C LCD Character Set

Table C-1 on the next page shows the hexadecimal values that correspond to ASCII characters on the LCD. Use this table as a reference when you enter LCD characters for the Display Line fields in the MODE SELECT (15h) command.

Table C-1 Hexadecimal values for LCD characters

D Error Codes

This appendix lists the ASCs (Additional Sense Codes) and ASCQs (Additional Sense Code Qualifiers) for library errors. The ASCs and ASCQs are associated with the sense keys returned by the library in response to a REQUEST SENSE command (see Chapter 14). The error descriptions are listed in order by ASC and ASCQ for each of the sense keys.

Not Ready (Sense Key 2h)

During a Not Ready condition, the library returns Check Condition status in response to each motion command until the Not Ready condition is removed. During this time, the sense key is set to Not Ready and the ASC and ASCQ are set to codes specifying why the library is not ready. All commands other than motion commands perform normally. Table D-1 lists Not Ready (2h) error conditions.

Table D-1 SC and SC values for the ot Ready (2h) sense ey

ASC (byte 12)	ASCQ (byte 13)	LCD Error Code	Description
04h	85h	5h	The library's door is open.
	86h	6h	The data cartridge magazine is missing.
	89h	9h	The library is in CHS Monitor mode.
	8Ch	Ch	The library is performing a power-on self-test (POST).
	8Dh	—	The library is in LCD mode.
	8Eh	—	The library is in Sequential mode.

Hardware Error (Sense Key 4h)

The library returns a sense key of Hardware Error (4h) when a hardware-related error occurs. After a Hardware Error occurs, the library will not accept motion commands. For each additional motion command, the library returns the same Hardware Error. For the TEST UNIT READY (00h) command, the library also responds with a Hardware Error sense key. All other commands are executed normally.

Table D-2 lists Hardware Error (4h) error conditions and indicates the LCD code that appears on the operator panel when each error occurs. The table also provides corrective actions for each error.

Table D-2 SC and SC values for the Hardware Error (4h) sense ey

ASC (byte 12)	ASCQ (byte 13)	LCD Error Code	Description	Corrective Action
3Bh	87h	1Ch	The CHM picked a cartridge that it could not seat properly. The CHM returned the cartridge to its source.	Recalibrate the cartridge sensor position as described in the library's operating instructions. If calibration does not solve the problem, contact your service provider.
		1Eh	The CHM attempted to pick a cartridge. The library could not detect a cartridge in the CHM, even though the sensors indicate there is.	
40h	80h	—	The CHM could not successfully pick and place a cartridge during a SEND DIAGNOSTIC self test. Either the sensor that detects whether there is a cartridge in the CHM is malfunctioning or there were no cartridges in the data cartridge magazine.	Make sure that there is at least one cartridge in the cartridge magazine. If cartridges are present and the error still occurs, recalibrate the cartridge sensor position as described in the library's operating instructions. If calibration does not solve the problem, contact your service provider.
44h	0h	—	An internal target failure occurred.	Contact your service provider.

ASC (byte 12)	ASCQ (byte 13)	LCD Error Code	Description	Corrective Action
81h	12h	12h	The CHM could not execute a retry when picking a cartridge from the tape drive.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If you cannot determine the problem, contact your service provider.
	13h	13h	The CHM could not move away from the cartridge magazine or tape drive when picking a cartridge.	The cartridge's dust cover may be caught in the tape drive. Check to see if the cartridge is placed halfway out of the tape drive. If it is, manually remove the cartridge and avoid using it in the library again. If the dust cover does not seem to be the problem, check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If you cannot determine the problem, contact your service provider.
	14h	14h	The CHM could not move toward the cartridge magazine or tape drive to pick a cartridge.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If you cannot determine the problem, contact your service provider.
	15h	15h	The CHM could not execute motions necessary to pick the cartridge from the tape drive.	Make certain the tape drive is mounted correctly, as described in the library's installation instructions. If the tape drive is not the problem, contact your service provider.
	16h	16h		
	1Ah	1Ah	The CHM was unable to pick a cartridge. The cartridge inventory indicates the location is full.	Check to see if there is a cartridge in the source. If there is, make sure that the cartridge is not caught in the source. If the cartridge is not caught, the CHM may not be gripping the cartridge correctly and you should contact your service provider.

ASC (byte 12)	ASCQ (byte 13)	LCD Error Code	Description	Corrective Action
81h	1Bh	1Bh	EXB-10h: The CHM was unable to pick a cartridge from the tape drive because the cartridge was not ejected. EXB-10e: The CHM was unable to pick a cartridge from the tape drive because the tape drive's door is closed.	If you want to restart the pick-and-place cycle, press the tape drive's unload button. If you do not want the CHM to pick from the tape drive, turn the library off and then on. Then, turn on the restart option using the operator panel. This ensures that the library starts its pick-and-place cycle from cartridge 1.
	C0h	C0h	The CHM was unable to place the cartridge back in the source after a pick failure.	Contact your service provider.
	C1h	C1h	The CHM was unable to place the cartridge back in the source after a place failure.	
82h	22h	22h	The CHM could not move upward to start the place procedure.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.
	23h	23h	The CHM could not move toward the cartridge magazine or the tape drive while executing a place procedure.	
	24h	24h	The CHM could not move downward to the tape drive while executing a place procedure.	
	25h	25h	The CHM could not move to a position where it could place a cartridge into the cartridge magazine or the tape drive.	Check to see if the data cartridge magazine is installed correctly. If the magazine is not the problem, this error could be caused by a misaligned CHM or an incorrectly mounted tape drive. Contact your service provider.
	27h	27h	The CHM could not execute one of the moves that ejects the cartridge.	This error could be caused by a misaligned solenoid on the CHM. Contact your service provider.

ASC (byte 12)	ASCQ (byte 13)	LCD Error Code	Description	Corrective Action
82h	28h	28h	The CHM has moved away from the cartridge magazine or the tape drive, but did not place the cartridge. The cartridge is still in the CHM.	This error could be caused by a bad solenoid on the CHM. Contact your service provider.
	29h	29h	The CHM could not execute one of the moves that ejects the cartridge.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.
	2Ah	2Ah		This error could be caused by a misaligned solenoid on the CHM. Contact your service provider.
	2Bh	2Bh	The CHM could not retract the horizontal zero position after it discovered a conflicting cartridge in the cartridge magazine or tape drive.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.
	2Ch	2Ch	EXB-10h: The CHM tried to place a cartridge in the tape drive, but a cartridge was already in the tape drive. EXB-10e: The CHM tried to place a cartridge into the tape drive, but the tape drive's door was closed.	Restart the pick-and-place cycle by following these steps: 1. Remove the cartridge from the tape drive. 2. Turn on the restart option. 3. Reset the library. The library will resume the pick-and-place cycle with cartridge 1 and will return the appropriate status to the host.
	2Dh	2Dh	The CHM could not move toward the cartridge magazine to place a cartridge into either slots 1 through 5 or slots 7 through 10.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.

ASC (byte 12)	ASCQ (byte 13)	LCD Error Code	Description	Corrective Action
83h	30h	30h	The CHM could not complete a procedure that allows it to define zero on the horizontal axis.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.
	31h	31h		Reset the library. If the error still appears, contact your service provider. You may need new firmware.
	32h	32h		
	33h	33h		Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.
	34h	34h		
	35h	35h	The CHM could not complete a procedure that allows it to define zero on the vertical axis.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.
	36h	36h		Reset the library. If the error still appears, contact your service provider. You may need new firmware.
	37h	37h	The CHM could not complete a procedure that allows it to define zero on the vertical axis.	Reset the library. If the error still appears, contact your service provider. You may need new firmware.
	38h	38h		Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.

ASC (byte 12)	ASCQ (byte 13)	LCD Error Code	Description	Corrective Action
84h	41h	41h	EXB-10h: The CHM could not move to the vertical axis position where it starts pushing the cartridge into the tape drive. EXB-10e: The CHM could not move to the vertical axis position where it starts pushing against the tape drive door to close it.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.
	42h	42h	EXB-10h: The CHM could not move to the horizontal axis position where it starts pushing the cartridge into the tape drive. EXB-10e: The CHM could not move to the horizontal axis position where it starts pushing against the tape drive door to close it.	
	43h	43h	EXB-10h: The CHM could not insert the cartridge into the tape drive. EXB-10e: The CHM could not close the tape drive door.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.
	44h	44h	EXB-10h: The CHM could not move to the horizontal axis zero position after inserting the cartridge in the tape drive. EXB-10e: The CHM could not move to the horizontal axis zero position after closing the tape drive door.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.

ASC (byte 12)	ASCQ (byte 13)	LCD Error Code	Description	Corrective Action
84h	45h	45h	EXB-10h: The CHM could not insert a cartridge in the tape drive after several retries. EXB-10e: The CHM could not close the tape drive door after several retries.	This error could be caused by an incompatible tape drive and cartridge. If you installed a non-XL tape drive and are trying to load an XL cartridge, the tape drive will not accept it. This error could also be caused by a servo error in the tape drive's firmware. If there is a servo error, the tape drive will not accept a cartridge. To clear a servo error in the tape drive, turn the library off and then on, or reset the SCSI bus. EXB-10e only: If the tape drive has been used frequently in the past, the latch on the door might be worn out. Try closing the door manually. If it does not close, the door latch may be broken. If this is the case, you must replace the tape drive, as described in the library's installation instructions.
	46h	46h	EXB-10e only: The CHM failed to close the tape drive door after several retries and the CHM did not stall against the tape drive door as expected.	Calibrate the tape drive position, as described in the library's operating instructions. If this does not solve the problem, contact your service provider.
	47h	47h	EXB-10e only: After several attempts, the CHM could not make one of the moves necessary to close the tape drive door.	Check to see if something is blocking the CHM or the tape drive's door. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.

ASC (byte 12)	ASCQ (byte 13)	LCD Error Code	Description	Corrective Action
84h	48h	48h	EXB-10e only: After several attempts, the CHM could not make one of the moves necessary to close the tape drive door.	Check to see if something is blocking the CHM or the tape drive's door. If there is, remove the obstruction and reset the library. If the error still appears, there may be a problem with the tape drive. Replace the tape drive as described in the library's installation instructions.
	49h	49h		Check to see if something is blocking the CHM or the tape drive's door. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.
85h	50h	50h	The CHM could not move to the physical position that corresponds to the logical position specified.	Reset the library. If the error still appears, contact your service provider.
	51h	51h	The CHM could not move to the horizontal axis zero position before starting the vertical axis move.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.
	52h	52h	The CHM could not move to the specified vertical position.	
86h	60h	60h	Internal error.	Reset the library. If the error still appears, contact your service provider.
	61h	61h	Invalid nonvolatile RAM.	
	62h	62h	The library could not initialize the vertical motion parameters properly.	
	63h	63h	The library could not initialize the horizontal motion parameters properly.	
	64h	64h	A CHM motion took longer than the maximum time allocated for it. When motion functions do not complete in the allocated time, the currents to the servo motors are shut off.	Reset the library. If the motors still move slowly, contact your service provider.
86h	65h	65h	The library could not initialize the SCSI hardware.	Turn the library off and then on again. If the error still appears, contact your service provider.

ASC (byte 12)	ASCQ (byte 13)	LCD Error Code	Description	Corrective Action
88h	81h	81h	EXB-10e only: The library could not perform the tape drive calibration because the tape drive door is closed.	Open the tape drive's door and then reset the library. The tape drive should perform the calibration procedure.
	82h	82h	EXB-10e only: The library could not perform the tape drive calibration because there is a cartridge in the CHM.	Remove the cartridge from the CHM and then reset the library. The tape drive should perform the calibration procedure.
	86h	86h	EXB-10e only: The library could not perform one of the tape drive calibration vertical moves.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.
	87h	87h	EXB-10e only: The library could not perform one of the tape drive calibration horizontal moves.	
	88h	88h	EXB-10e only: The library has exhausted the possible positions for picking from the tape drive. It could not find a position where it could pick reliably.	Make certain the tape drive is mounted correctly, as described in the installation instructions for your library. If the error still appears, contact your service provider.
	89h	89h	EXB-10e only: The library could not perform tape drive calibration on the horizontal axis.	The tape drive's horizontal axis position may be out of range. Try reinstalling the tape drive as described in the installation instructions for your library. If the tape drive is installed correctly, check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.

ASC (byte 12)	ASCQ (byte 13)	LCD Error Code	Description	Corrective Action
88h	8Ah	8Ah	EXB-10e only: The library could not perform the tape drive calibration because there is a cartridge in the tape drive.	Manually remove the cartridge from the tape drive. Make sure that there is no cartridge in the CHM. For the EXB-10e, make sure that the tape drive's door is open. Then, reset the library.
	8Bh	8Bh	EXB-10e only: The library tried to locate a cartridge in the cartridge magazine for tape drive calibration but could not find one.	Install a cartridge in the cartridge magazine and reset the library.
89h	90h	90h	The CHM could not start the move to the cartridge sensor calibration position.	First, check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. Next, recalibrate the cartridge sensor position as described in the operating instructions for your library. If the error still appears, contact your service provider.
	91h	91h	The CHM could not move to the sensor calibration start position.	
	92h	92h	The CHM could not find the cartridge sensor.	Make certain the calibration block is correctly placed in the CHM. If it is and you still receive this error, the **cartridge sensor is malfunctioning. Contact your service provider.**
	93h	93h	The library is waiting for you to insert the calibration block.	Insert the calibration block and close the library's door.
	94h	94h	The CHM could not complete the calibration.	First, check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. Next, recalibrate the cartridge sensor position as described in the operating instructions for your library. If the error still appears, contact your service provider.
	95h	95h	The library could not locate the cartridge sensor position.	Contact your service provider. The cartridge sensor may be malfunctioning.

ASC (byte 12)	ASCQ (byte 13)	LCD Error Code	Description	Corrective Action
89h	96h	96h	A motion error occurred while the CHM was searching for the cartridge sensor position.	First, check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. Next, recalibrate the cartridge sensor position as described in the operating instructions for your library. Make sure that the calibration block is fully seated. If the error still appears, contact your service provider.
	97h	97h	The CHM could not move to the horizontal zero position after completing the cartridge sensor calibration.	
	98h	98h	Internal error.	Contact your service provider.
	9Ch	9Ch	The calibration is complete and the library is waiting for you to remove the calibration block.	Remove the calibration block and close the library's door.
8Ah	A0h	A0h	An unrecoverable hardware error occurred while the library was checking for the presence of a cartridge in the CHM. No more motion commands will be accepted until you reset the library.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.
	A1h	A1h		
	A2h	A2h	Internal error.	Contact your service provider.
	A3h	A3h		
8Bh	B0h	B0h	The CHM could not move to the start position for the eject position calibration.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.
	B1h	B1h	The CHM could not execute a move that prepares for the eject position calibration.	
	B2h	B2h	The solenoid did not eject.	The solenoid is malfunctioning. Contact your service provider.
	B3h	B3h	The CHM could not move to the "start push in" position.	Check to see if something is blocking the CHM. If there is, remove the obstruction and reset the library. If the error still appears, contact your service provider.
8Bh	B4h	B4h	There is a cartridge in the CHM.	Remove the cartridge and retry the calibration procedure by resetting the library.

ASC (byte 12)	ASCQ (byte 13)	LCD Error Code	Description	Corrective Action
8Ch	C0h	C0h	The CHM was unable to place the cartridge back in the source after a pick failure.	Contact your service provider.
	C1h	C1h	The CHM was unable to place the cartridge back in the source after a place failure.	
	C2h	C2h	The CHM was unable to place the cartridge back in the source after a SCSI abort.	

Illegal Request (Sense Key 5h)

Table D-3 lists Illegal Request (5h) error conditions.

Table D-3 SC and SC values for the llegal Re uest (5h) sense ey

ASC (byte 12)	ASCQ (byte 13)	Description
1Ah	00h	The parameter list length was not valid (appears in the MODE SELECT command).
20h	00h	The operation code (OP code) for the CDB was invalid. The library will receive all the CDB bytes if the OP code had a valid Group Code. If the OP code did not have a valid Group Code, the library will go to Status phase after the first byte in the Command phase and return Check Condition status.
24h	00h	There were invalid fields in the CDB.
	80h	There was an invalid element address specified in the CDB.
25h	00h	The logical unit specified in the Identify message or in the CDB was not zero.
26h	00h	There was an invalid field in the parameter list.
3Bh	0Dh	The destination element was occupied for a MOVE MEDIUM command.
	0Eh	The source element was empty for a MOVE MEDIUM command.
	80h	The CHM was occupied for a MOVE MEDIUM command.
	81h	A MOVE MEDIUM command was issued and both the source and destination element were the CHM.
	83h	EXB-10h: The source element in a MOVE MEDIUM command was the tape drive and the tape drive was empty or the cartridge was not ejected. EXB-10e: The source element in a MOVE MEDIUM command was the tape drive and the tape drive's door was closed.
	84h	EXB-10h: The destination element was the tape drive and the tape drive already contained a cartridge. EXB-10e: The destination element was the tape drive and the tape drive's door was closed.
	85h	The destination element in a POSITION TO ELEMENT command was park, but there is a cartridge in the CHM and the library could not move to park.

ASC (byte 12)	ASCQ (byte 13)	Description
3Bh	86h	EXB-10h: The destination element in a POSITION TO ELEMENT command was the tape drive, but a cartridge was in the tape drive and in the CHM. EXB-10e: The destination element in a POSITION TO ELEMENT command was the tape drive, but there is a cartridge in the CHM and the tape drive's door is closed. This move is not allowed because if the tape drive's door opens while the CHM is positioned at the tape drive with a cartridge, the cartridge will be knocked out of the CHM.
	87h	The source cartridge could not be seated.
3Dh	00h	There were invalid bits in the Identify message. Either one of the reserved bits was nonzero or the LUNTAR field was nonzero.
40h	80h	A cartridge could not be detected. Either the data cartridge magazine was empty or the cartridge sensor did not work correctly.
	81h	There was a cartridge in the CHM when the library received a SEND DIAGNOSTIC command with one of the following tests specified: self test, tape drive calibration test (EXB-10e only), cartridge sensor calibration test, eject calibration test, or the pick-and-place test.
	82h	EXB-10h: The tape drive contained a cartridge and the initiator sent a SEND DIAGNOSTIC command with the Verify Pick and Place Functionality page. EXB-10e: The tape drive's door was closed and the initiator sent a SEND DIAGNOSTIC command with the Verify Pick and Place Functionality page.
	83h	There was no cartridge in the data cartridge magazine and the initiator sent a SEND DIAGNOSTIC command with the Tape Drive Calibration page.
	84h	There was a cartridge in the tape drive and the initiator sent a SEND DIAGNOSTIC command with the Tape Drive Calibration page.
91h	00h	An error occurred during an initialize element status operation (a cartridge was in the CHM).

Unit Attention (Sense Key 6h)

The library does not stack Unit Attention conditions. Whenever there are two or more Unit Attention conditions, the library reports only the last one encountered. A Unit Attention condition remains in effect for a particular initiator until that initiator clears it.

If the library has not returned Check Condition status for the Unit Attention condition generated, the library responds in the following manner:

- In response to a REQUEST SENSE command, the library reports a sense key of Unit Attention (the ASC and ASCQ bytes provide additional information about the condition). Then, the library clears the Unit Attention condition.

- In response to an INQUIRY command, the library performs the INQUIRY command but does not clear the Unit Attention condition.

- In response to any other command, the library returns Check Condition status for the command. The command is not performed and the Unit Attention condition is not cleared.

If the library has already returned Check Condition for the Unit Attention condition, the library responds in the following manner:

- In response to a REQUEST SENSE command, the library reports a sense key of Unit Attention (the ASC and ASCQ bytes provide additional information about the condition). Then, the library clears the Unit Attention condition.

- In response to an INQUIRY command, the library performs the INQUIRY command but does not clear the Unit Attention condition.

- In response to any other command, the library clears the Unit Attention and associated sense data. Then, the library performs the requested command.

Table D-4 lists combinations of ASC and ASCQ values for the Unit Attention sense key (6h).

Table D-4   SC and SC values for the nit ttention (6h) sense ey

ASC (byte 12)	ASCQ (byte 13)	Description
04h	89h	The library was in sequential mode, CHS Monitor mode, or LCD mode.
28h	00h	The library's door was opened and then closed.
29h	00h	A power-on, SCSI bus, or bus device reset occurred.
2Ah	01h	Mode parameters have been changed. Issue a MODE SENSE (1Ah) command to determine what the new mode parameters are.
3Fh	01h	New firmware was loaded.

Aborted Command (Sense Key Bh)

Table D-5 lists Aborted Command (Bh) error conditions.

Table D-5   SC and SC values for the borted Command (h) sense ey

ASC (byte 12)	ASCQ (byte 13)	Description
43h	00h	The library received a message at an invalid time.
44h	*nn*h*	The library firmware encountered an internal inconsistency. Contact your service provider. *The ASCQ for this ASC can be any of about 20 values that indicate where in the firmware the inconsistency was discovered.
47h	00h	Either the message system was disabled and the library discovered a parity error on the SCSI bus, or the message system was enabled and the initiator rejected a Restore Data Pointers message that the library sent to recover from a parity error.
48h	00h	Either the library received an Initiator Detected Error message at an inappropriate time, or the initiator rejected a Restore Data Pointers message that the library sent in response to the Initiator Detected Error message.
4Eh	—	The library disconnected while executing a MOVE MEDIUM, SEND DIAGNOSTIC, or POSITION TO ELEMENT command. During this time, the same initiator that issued the motion command also selected the target and tried to issue another command. When this error occurs, the library terminates the current connection with Check Condition status and aborts the motion command in progress for that initiator.

Notes:

Glossary

nnb Numbers followed by a b are binary values.

nnh Numbers followed by an h are hexadecimal values.

μs Microseconds.

address See *SCSI ID*.

ANSI American National Standards Institute. Library implementation is based on ANSI's *Small Computer System Interface-2* standard.

ATN Attention signal. The initiator asserts this signal on the SCSI bus to indicate that it has a message to transmit to the target.

BSY Busy. An "OR-tied" signal on the SCSI bus that indicates the bus is being used.

bus A signal line or a set of signal lines used by an interface system (for example, SCSI) to connect a number of devices in order to transfer information to and from those devices. For example, the SCSI cables used to connect the host computer to the library serve as a bus.

bus phase The SCSI protocol for controlling communication on the SCSI bus, such as the direction and type of information on the data lines.

byte Eight bits or one character.

CDB Command descriptor block. The structure used to communicate commands from an initiator to a target.

CHM Cartridge handling mechanism. In the library, the robotic component that retrieves and replaces 8mm data cartridges in the data cartridge magazine and loads and unloads them from the tape drive. The CHM is the medium transport element of the library.

CHS Cartridge Handling Subsystem (library), such as the EXB-10h or EXB-10e.

CTS Cartridge Tape Subsystem (tape drive). The tape is the data transfer element of the library.

data cartridge magazine In the library, the black plastic frame that can store up to ten 8mm data cartridges. The data cartridge magazine is the storage element of the library.

EXB-8200 The EXB-8200 8mm Cartridge Tape Subsystem. The EXB-8200 is a full-high 8mm tape drive that can store up to 2.5 gigabytes of data on a single EXATAPE 112m 8mm data cartridge.

EXB-8200SX The EXB-8200SX Cartridge Tape Subsystem. The EXB-8200SX is similar to the EXB-8200 but has high-speed search capability.

EXB-8205 The EXB-8205 8mm Cartridge Tape Subsystem. The EXB-8205 is a half-high 8mm tape drive that can store up to 5 gigabytes of data on a single EXATAPE 112m 8mm data cartridge, assuming an average 2:1 compression ratio.

EXB-8205XL The EXB-8205XL 8mm Cartridge Tape Subsystem. The EXB-8205XL is a half-high 8mm tape drive that can store up to 7 gigabytes of data on a single EXATAPE 160m XL 8mm data cartridge, assuming an average 2:1 compression ratio.

EXB-8500 The EXB-8500 8mm Cartridge Tape Subsystem. The EXB-8500 can store up to 5.0 gigabytes of data on a single 8mm data cartridge.

EXB-8500c The EXB-8500c 8mm Cartridge Tape Subsystem. The EXB-8500c is physically similar to the EXB-8500, but offers data compression as an option. Assuming an average compression ratio of 2:1, the EXB-8500c can store up to 10 gigabytes of data on a single EXATAPE 112m 8mm data cartridge.

EXB-8505 The EXB-8505 8mm Cartridge Tape Subsystem. The EXB-8505 is a half-high 8mm tape drive that can store up to 10 gigabytes of data on a single EXATAPE 112m 8mm data cartridge, assuming an average 2:1 compression ratio.

EXB-8505XL The EXB-8505XL 8mm Cartridge Tape Subsystem. The EXB-8505XL is a half-high 8mm tape drive that can store up to 14 gigabytes of data on a single EXATAPE 160m XL 8mm data cartridge, assuming an average 2:1 compression ratio.

FCC Federal Communications Commission.

GB Gigabyte.

gripper On the library's cartridge handling mechanism, the plastic fingers that hold a cartridge as it is being picked and placed.

h Hexadecimal.

host See *initiator*.

Hz Hertz.

ID Identification.

initiator A SCSI device (usually a host system) that requests an I/O process to be performed by another SCSI device (a target).

I_T nexus A nexus that exists between an initiator and a target.

I_T_L nexus A nexus that exists between an initiator, a target, and a logical unit. This relationship replaces the prior I_T nexus.

KHz Kilohertz.

KB Kilobyte.

LCD Liquid crystal display. The four-line display on the front of the library is an LCD.

library The EXB-10e or EXB-10h.

LUN Logical unit number. The library is a single device target and does not support multiple devices under its SCSI ID, so it only supports a LUN of 0.

MB Megabyte.

ms Millisecond.

nexus A relationship that begins with the establishment of an initial connection and ends with the completion of the I/O process.

ns Nanosecond.

power-on self-test The process that occurs when the library and tape drive perform their initial power-on diagnostics.

SCSI Small Computer System Interface.

SCSI-2 Small Computer System Interface-2.

SCSI device   A host adapter or a target controller that can be attached to the SCSI bus.

SCSI ID   A unique address (0 to 7) assigned to each device or subsystem attached to a SCSI bus.

target   A SCSI device that performs an operation requested by an initiator.

VAC   Volts AC.

VDC   Volts DC.

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